Trade Integration and Financial Integration - individual, firm and country perspective

A thesis presented

by

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Contents

List of Figures

List of Tables

Introduction

Globalisation consists of many small components and every component entails different effects. The main part of globalisation is international integration of goods, service, financial and factor markets. This integration is accompanied by international trade in goods, services and finance. According to the WTO Trade Report (2008), the increase in international trade exceeded the growth in global output in the year 2007 by 2 percentage points. A further prominent aspect of globalisation is the increase and composition of international capital flows. Foreign direct investment increased during the 1990s by more than 20 % and thereby exceeded international portfolio flows (WTO 2008). Both integration processes have lead to more efficient allocation of economic resources and greater levels of output. However, an additional result of the international trade integration is higher uncertainty due to intensified production specialization, increased competition and economic cross-country spillovers. Various groups of individuals such as workers, firm owners and political leaders are differently affected by these risks. Yet, financial integration offers the possibility to diversify these new arising risks. Again, the affected groups benefit differently from these diversification possibilities.

One of the first historical links between trade liberalisation and financial liberalization can be found in 1846 in the repeal of the English Corn Laws. In course of the financial liberalization English landowners were able to diversify their portfolios away from agricultural goods and thus reduced their opposition to protection of the English agricultural industry (Schonhardt-Bailey (1991, 1996)). Following these arguments, Eaton and

Grossman (1985) analyse whether trade protection can serve as a social insurance or trade liberalization reduces this insurance. Hence, the need for new diversification possibilities increases. According to these authors, liberalization leads to higher competition and enforces imports. This entails higher uncertainty for workers in the import competing industries. Hence, for working individuals tariffs have an insurance task. Feeney and Hillman (2004) support these results. They indicate that a free access to asset markets might be a substitute for trade protection. With proceeding asset market liberalization the demand and political support for trade protection decreases. All these studies take the financial liberalization as exogenous and trade liberalization as consequence of it. Yet, empirically there is no definite evidence for the direction of this argumentation. Various empirical studies also confirm the possibility of financial liberalization as a consequence of trade liberalization.[1]

Aizenman (2004) and Tamirisa (1999) both present theoretical arguments for trade liberalization as a cause for financial liberalization. Increasing trade and imports offer possibilities to bypass capital controls. The impact of such controls and repressions is diluted and if enough pressure is built up, financial markets will be adjusted to free capital flows and activities. Still, the cutback of capital controls and financial repressions does not necessarily stimulate individuals to take part in financial markets activities and portfolio diversification. This thesis tries to close this gap by generalizing these approaches.

The first part of the present work links the two views of the literature. Analogue to the first strand of arguments, we consider tariffs as insurance for workers in the import competing industry. Trade liberalization and increasing imports are the source of additional

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[1]   See for example Svaleryd and Vlachos (2003).

uncertainty of labour income. In contrast to these studies, we endogenize financial market activities and take different trade regimes (different levels of protectionist trade policy and free trade) as exogenous government actions. Furthermore, as expansion of the second argument we generalize our study away from specific capital controls towards individual activities on the asset market. We analyse whether and how a working individual exhausts its financial diversification possibility as a consequence of different trade regimes. Thus, the working individual takes the trade regime as given and adjusts its portfolio according to the existing tariff. For the individual portfolio decision it is crucial whether the individual receives its labour income from the import competing or the exporting industry. The results imply that trade liberalization increases individual activities on financial markets for individuals working in the former protected industry and tends to decrease asset market activities for individuals in the unprotected industry. Thus, the argument that tariffs serve as a social insurance may be confirmed also with exogenous trade regimes and even according to this more generalized approach.

Not only workers are affected by increased uncertainty due to globalization. Firm owners are also faced with challenges caused by higher competition, a greater variety of location choices and different environmental conditions in each possible production location. One main question is whether a firm chooses to sell its products internationally or just to serve the home market. If a firm decides to engage in the international market then the next consideration is whether it should export or undertake direct international investments to capture international market shares. Again the decision to invest internationally can be broken down into whether to build a complete new firm or to place only specific iso-

lated production steps abroad. Melitz (2003) indicates that the decision which markets to serve - home or home and foreign - depends mainly on firm size and productivity. He concludes that in a setting with heterogeneous firms according to firms' size, only large firms serve the home and foreign market. Small firms with low productivity do not engage in international exports. Grossman et al. (2006) extend this analysis and derive the optimal international strategy of firms with respect to the firm's productivity. According to Grossman et al. (2006), lowest productive firms only serve the home market and, with increasing productivity, firms start to export and even invest in international direct investments. These results are refined by Grossman et al. (2005). They analyse the location choice and segmentation of the production process for a multinational firm in dependence of the location conditions.

The existing research on international direct investment concentrates on the direct investment and the decisive factors for this investment. They neglect the possibility of combining the direct investment with different investment possibilities such as for example portfolio investment. Allowing firms to combine various investment instruments offers them the possibility to prop up short term variations of the international direct investment. This in turn may facilitate the direct investment. The second part of the present work adds these considerations to the existing research. The international investment decisions of a representative firm are analysed in a dynamic setting. In contrast with recent studies, the firm can choose between isolated direct investment, isolated portfolio investment or a combination of both international investments. We assume that firms want to undertake international direct investment for sure. The research question is what kind of investment

strategy would be the best. Our results indicate that the combination of both international investments is preferred by the firm. According to the results, the firm uses portfolio investment to diversify the short-term variations of the direct investments and the firm is able to engage in the international market with a lower productivity in comparison to the isolated direct investment.

The results of both the first and the second part of the present work emphasize the impact of the economic environment such as the countrie's industrial landscape and conditions on the respective individual portfolio or the firm's investment decision. On the other hand, international trade and the increased possibilities for firms to produce and invest internationally have impacted the industrial patterns of different countries. The consequences from industrial concentration or the offshoring of several production steps might not only impact the industrial landscape of a country but also its total economic environment including financial markets and business cycles. There are different opinions about the impact and its direction from trade on business cycles. The most prominent ones are Krugman (1993) and Frankel and Rose (1998). Krugman (1993) states that international integrated countries are more diversified than unintegrated countries due to industrial specialization and trade. In contrast, Frankel and Rose (1998) conclude that demand shocks dominate and the economic environment of trading countries converges. The ambiguous results are not clarified yet. Thus, the risk-sharing literature offers no definite statement either. For example, Crucini (1999) states that regions of a similar country share more risk among each other than internationally. Hess and Shin (1998), on the other hand conclude that the U.S. states share less risk with each other than with other countries.

Obviously, there are different transmission channels through which countries can be affected by international integration and various impacts on the risk-sharing within a country group. Additionally, it seems that these effects are not only working in one direction but there may be mutual impact of specialization, trade and financial integration. The third part of the present work analyses these transmission channels for three different country groupings. In contrast to the existing literature, we apply different measures of risk sharing in a simultaneous equation system. The simultaneity allows to capture mutual impacts between trade, specialization and financial integration. Thus, we can identify different transmission channels for the respective country groups and the impact on intra- or inter-group risk sharing.

Generally, the present work analyses the diverse impact of international integration on workers, firm owners and on country patterns. In particular, the consequences of proceeding international integration on risk sharing for the respective groups are emphasized.

The first chapter emphasizes the influence of trade policy on the investment decisions of working individuals. In the investment behaviour of individuals the uncertainty of future income is considered. The optimal portfolio-decision of a representative working individual is analysed in comparison to a non-working shareholder.

Chapter 2 concentrates on firm behaviour with different international investment possibilities. We show in a dynamic investment setting whether firms choose FDI or international portfolio investment (FPI) in the presence of stochastic productivity taking into account differences in flexibility of both investments.

We explore the impact of different trade patterns on industrial specialization and consequently on business cycle co-movements between and within different regions in Chapter 3. In particular, we emphasize industrial specialization as a result of intra- or inter-industry trade. Ultimately, the purpose is to clarify direct and indirect channels between trade, specialization, business cycle co-movements and risk sharing.

Chapter 1
Trade Policy and Risk Diversification

1.1 Introduction

Since the mid 1960's, we have witnessed an overwhelming and continuing trend towards globalization and free trade (Wei and Wu (2002)). Among many other institutions, the Doha round of World Trade Organizations has recently reiterated the call to lower trade barriers. Despite the numerous benefits of free trade, this kind of liberalization carries with it a loss of protection caused by sudden increasing competition and higher imports. Subsequently higher profit risk for many sectors and their associated workforce arises.[2]

Conversely, we can also observe an almost unbridled expansion of speculative financial markets.[3] Deregulated financial markets can act as tools to dampen financial and non-financial risk and thereby offer some form of insurance. Furthermore, trade liberalization may also be linked to financial integration, analogous to the manner in which the novel risks introduced by trade liberalization are absorbed to varying degrees by financial markets. The mentioned risks which come along with trade liberalization lead to higher uncertainty for different groups of individuals, especially workers. This increased uncertainty can be reduced by diversifying the individual investment portfolio on the financial market.

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[2]   See Baldwin (1982) for a detailed discussion.

[3]   For empirical evidence on this development see for example Prasad, Rogoff, Wei and Kose (2003).

Based on these considerations, we assume that the continuing trade liberalization strengthens the desire to diversify risk – especially labour income risk – through financial markets. This leads to the question of whether protectionist trade policy therefore reduces individual diversification on the asset market. Moreover, a stronger dependence on personal labour income could result from a reduction in diversification opportunities, and we will examine whether this is indeed the case.

To answer these questions we consider the influence of trade policies on the investment decisions of a representative working individual. In the following analysis, a working individual has the option to hedge his or her income risk by investing in two different risky assets and one risk-free asset. The two risky assets are shares in the industries x and y, respectively, with different correlations between their expected returns and varying correlations with the wage risk. Moreover, the variation of the income risk is the deciding factor in the optimal portfolio-decision. Claims on future labour income are not tradable. The investment decision of the working individual is mainly determined by the asset covariance and labour asset covariance. Furthermore, the tariff impact on the covariance depends on the factor intensities, the composition of the productivity shocks, and the relative prices in the two home country industries. In this regard, we can confirm and extend the findings of Mayer (1984). He shows for a Heckscher-Ohlin model as well as for a model with specific factors that under the assumption of a Median Voter Model the preferred tariff policy of a country depends on the factor-ownership distribution. In addition, it appears in the present chapter that variations in the total risk share can dilute the results.

Feeney and Hillman (2004) additionally indicate that the liberalization state of the financial market impacts the desire for a protectionist trade policy. The authors argue that if more risk can be diversified on the financial market by individuals - increasing liberalization of the financial market - then individuals are not demanding a protectionist trade regime. Thus, the willingness to lobby for a high tariff decreases with increasing individual access to financial markets. Cassing (1996) analyses the consequences of tariff lobbying in a Principal-Agent Model. He assumes that the manager of a firm has impact on the tariff implementation of the industry of the firm he works for. The manager's willingness to lobby for a high tariff depends on the stakes he owns in the firm. Cassing implies that a tariff introduction leads to additional gains in the protected industry and hurts the unprotected industry. As a consequence of the tariff introduction, there is an investment concentration by shareholders - not managers - in the protected industry.

Both papers indicate that there is a link between trade integration and financial integration. However, they neglect possible mutual effects of a tariff between the industries. Furthermore, it is not empirically proven that the only direction of the impact is that financial integration pushes trade liberalization.[4] This is where the present chapter adds to. We generalize the arguments of Feeney and Hillman (2004) as well as Cassing's (1996). Additionally, we analyse whether trade integration impacts financial integration. Therefore, we study individual investment behaviour in dependence of different tariff settings. Furthermore, we allow for mutual effects between the industries and emphasize their impact on the individual investment behaviour as well. Finally, we indicate whether financial markets

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[4] See for example Svaleryd and Vlachos (2002) or Aizenman (2008).

and tariffs are substitutes for individual insurance needs. The introduction of an import tariff substantially impacts the utilization of the asset market. Although the asset market does not lose its role as an insurance instrument completely, risk diversification via the asset market diminishes considerably as a consequence of the implementation of a tariff. In contrast to Cassing (1996), we see no definite investment concentration in the protected sector. On the contrary, we find a weak portfolio bias towards the unprotected industry.

This chapter is organized based on the following sub-topics. The next section provides a brief overview of relevant literature. Section three discusses the production side, and section four derives the individual portfolio decision. Section five analyses the optimal asset allocation of a working individual under a protectionist trade regime and the possible labour income risk hedge. Section six concludes Chapter 1.

1.2 The Literature

To model individual portfolio-choice, we will focus on the model elucidated by Campbell and Viceira (2003). Furthermore, we extend their model by a second risky asset. The standard portfolio-theory analyses the portfolio decision between one risky and one risk-free asset. Correlations between the expected returns of risky assets are often neglected. In our analysis a second risky asset is very important to emphasize the effects of the trade policy and possibilities of the income hedge. With the second risky asset we can explore whether the tariff implementation causes a rebalancing of the portfolio composition and how the asset allocation changes between the protected and the non-protected industry. Furthermore, the second risky asset allows combining two different views of capital income

as an alternative income source for a working individual and thus leads to literature dealing with the correlation between wages and capital income.

Bodie et al. (1992) and Viceira (2001) provide more general approaches of portfolio decisions with labour income. Bodie et al. (1992) illustrate the portfolio decision for an individual with non-tradeable labour income. In contrast to the present chapter, they analyse the portfolio decision with riskless labour income. The main result of their paper is that with a higher non-tradeable share of income the individual will shift an additional proportion of financial wealth in the risky asset. The underlying assumption is that total wealth is constant. On the other hand, Viceira (2001) examines a dynamic model of portfolio decision with background risk. He distinguishes between investors with and without uncorrelated background risk. These investor types can be reinterpreted as young and old investors. The main finding of this analysis is that young investors are endowed with less financial wealth and more background risk, uncertain human capital income, than older investors. Hence, younger investors should decide to hold a riskier portfolio than old investors. In the present chapter, we do take into account the non-tradable character of the labour income. Furthermore, we also analyse how uncertainty of the labour income influences the individual portfolio choice. In our examination, the different levels of uncertainty of the labour income do not arise through different age stages but tariff choices. Yet, we do not distinguish between young and old investors as our analysis emphasizes the impact of risky labour income on the individual investment decision. Hence, we also allow possible variations in the capital income to affect the individual investment decision.

The effects of a positive correlation between wage and capital income were first shown by Weitzman (1984) and further developed by Renström and Roszbach (1995). They find positive effects on productivity, ultimately resulting in prolonged employment, when workers hold shares of the company they work for. Harms and Hefeker (2003) analyse the effects of an alternative capital income that is negatively correlated with labour income of workers (union members) on employment. They conclude that if capital and labour income are negatively correlated then the workers become more independent of labour income. As a consequence, the additional income source weakens union wage demands. Harms and Hefeker conclude that this results in an increased rate of employment as well. In the present chapter, we consider a positive as well as a negative correlation between labour and capital income. The various results of additional capital income in the literature justify the variation of the income risk correlation. We will examine which of the investment alternatives will be preferred by the representative individual given the different trade regimes. Furthermore, we compare poor workers with wealthy workers. This means the poor individual is not willing to bear a high amount of risk in his portfolio in order to obtain a high return. The wealthy individual on the other hand allows a high share of risk in his portfolio if a high return is possible. The present chapter shows that the wealthy individual does not depend as much on the industry return he works for as the poor individual. This finding supports the already existing results that additional capital income may loosen the dependence on labour income.

A further aspect discussed in the literature finally links trade liberalization and asset market development. Eaton and Grossman (1985) and Cole and Obstfeld (1991) make

a case for financial openness enforcing the trade liberalization for goods. They argue that risk diversification via financial markets substitutes the insurance effect of protectionist trade policy. Additionally, Cassing (1996) analyses the portfolio allocation of shareholders and the lobbying behaviour of their firm managers in dependence of the trade regime. Both actors have only capital income and no working income. Feeney and Hillman (2004) advance this approach and show in a political economic approach how increasing risk diversification over asset markets reduces the demand for protectionist trade policy. Again, the individuals gain only capital and no working income. Feeney and Hillmann demonstrate that complete capital markets offer diversification of risks and decrease the demand for a protectionist trade policy. However, this impact of the joined development of capital markets and trade liberalization is not unambiguous, as the opposite argument is valid as well: trade liberalization raises the need for risk diversification over the capital market. As a consequence, the increased insurance demand enforces the development of the capital-markets. Svaleryd and Vlachos (2002) demonstrate a significant linkage in their empirical study of financial development in conjunction with trade liberalization. At the time, the authors were unable to conclusively determine a clear direction or propose an explanation for this dependency, a number of approaches have since been developed to offer insight into the forces jointly affecting trade liberalization and financial integration. For example, Aizenman (2008) offers an explanation for commercial openness driving financial openness. He shows that the pressure to open the financial system is a by-product of successful trade integration. Restrictions on financial markets lose their impact in the presence of increasing trade liberalization. On the other hand, Tamirisa (1999) explores empirically

the dependency from the opposite direction. Following her findings, exchange and capital controls can act as non-tariff-barriers (ntb) to trade. The final impact of these ntb depends on the relation between trade in goods and factors and the economic pattern of the country.

In order to build on the existing literature, especially on the previously discussed strand, we will examine whether and how a protectionist trade regime changes the investment behaviour of a working individual and influences its willingness to invest in the capital market. Therefore, we reverse the statement of Feeney and Hillman (2004). Feeney and Hillman study the positive impact of asset market development on proceeding trade liberalization. We examine whether trade policy affects the individual decision to invest in risky assets. Our second contribution is the observation of the portfolio-decision of a working individual with a risky wage. Therefore, we allow for positively and negatively correlated capital and working income. Furthermore, we compare the portfolio decision of a worker in the protected industry to the decision of a worker in the unprotected industry. Contrary to the previously mentioned literature, we will look at trade policy as exogenous and endogenize the individual diversification decision on the asset market. Emphasis will be placed on the effect of increasingly uncertain levels of future income on individual investment behaviour. To assess how globalization influences the portfolio choice, we will explore the influence of exogenous trade policy on portfolio optimization. In addition, we will evaluate if a labour income risk hedge is still possible under a protectionist trade policy.

All in all, we use a more general approach than the mentioned literature with exogenous trade policy and endogenous investment decision. Our results differ from the literature in the following way: we can not confirm a general statement about a stimulating effect on

the asset market caused by trade liberalization. Specifically, we show that the respective country pattern (which industries are hosted in the country and how they are related) and the position of the representative investor (willingness to bare risk and where he works) are decisive for the final impact of trade liberalization on asset market activities in different countries.

1.3   Production

The analysis is based on a standard Heckscher-Ohlin model, where a small open country trades with the rest of the world at exogenous terms of trade. The industry in the home country produces two final consumption goods x and y. Both goods are consumed at home. Furthermore, y is also exported and x is the import-competing good. The production of good x is labour intensive and that of good y is capital intensive. The world price of good x at time t is given by $p_{x,t} = \frac{P_x}{P_y}$. The government in the home country implements a tariff τ on good x. Hence, the relative price for good x in the home country is $p_{x,t}(1 + \tau_{x,t})$.

Each industry in the home country consists of n identical domestic firms using the same technology. The production function of one representative firm is:

$$F_{i,t}\left(L_{i,t}, K_{i,t}\right) = \phi_{i,t} K_{i,t}^{\beta_i} L_{i,t}^{1-\beta_i} \ \ with \ i = x, y \tag{1.1}$$

$K_{i,t}$ is the amount of capital and $L_{i,t}$ the amount of labour employed in the production process in industry i at time t. Production in both industries is affected by stochastic productivity shocks $\phi_{i,t}$ realised in period t. There are many different possible realizations

of $\phi_{i,t}$ and they occur with probability $q_{i,t}$. The values of these shocks are strictly positive and iid. In particular a positive productivity shock is realised if $\phi_{i,t} > 1$ and a negative one if $\phi_{i,t} < 1$; if $\phi_{i,t} = 1$, there is a shock free situation. Moreover, the occurrence of a specific productivity shock in sector x can be positively or negatively correlated with the appearance of a specific productivity shock in sector y and vice versa. Hence, the joined probability of shocks in both sectors is: $q_{xy,t} \neq q_{x,t}q_{y,t}$.

As a consequence the factor income is stochastic too. With perfect competition on product and factor markets, the domestic income for labour and capital respectively is:

$$w_{i,t} = p_{i,t} \left(1 - \beta_i\right) \phi_{i,t} K_{i,t}^{\beta_i} L_{i,t}^{-\beta_i} \tag{1.2}$$

$$r_{i,t} = p_{i,t}\beta_i\phi_{i,t}K_{i,t}^{\beta_i-1} L_{i,t}^{1-\beta_i}. \tag{1.3}$$

1.4 Portfolio Decision of the Worker

We consider a risk-averse individual throughout the complete analysis. The optimization problem of the individual is closely linked with the aim to hedge future income risk from labour. We derive the optimal asset choice for different constellations of risk. To analyse the hedging problem more clearly it is necessary to define the different available income sources in more detail.

1.4.1 Income sources

The representative individual contributes a fixed fraction of his time to work. $L_{i,t}$ is normalized to one and thus labour income $w_{i,t}$ is defined as in (1.2).

In addition to the labour income the individual has the possibility to generate capital income in period $t + 1$. The individual is endowed with an initial amount of fixed wealth V_t. The capital endowment consists of $V_t = r_{p,t}V_{t-1} + (w_t - C_t)$. The first term on the right hand side is the capital income from the investment in the previous period. The second term constitutes the current labour income w_t reduced of the amount the worker spends for current consumption C_t. V_t can be invested during period t in two risky assets $\alpha_{i,t}$ (industry-shares) with return $r_{i,t+1}$ and in the risk free asset with constant return r_f. Therefore, the total portfolio return in $t + 1$ will be

$$r_{p,t+1} = \alpha_{x,t}r_{x,t+1} + \alpha_{y,t}r_{y,t+1} + \alpha_{f,t}r_f, \tag{1.4}$$

where

$$1 = \alpha_{x,t} + \alpha_{y,t} + \alpha_{f,t}.$$

Assuming that there are no short-sales $\alpha_{i,t} \geq 0$, and that $\alpha_{i,t}$ refers to a proportionate share in the total available wealth, the portfolio return in $t+1$ can be rearranged as[5]

$$r_{p,t+1} = \alpha_{x,t}\left(r_{x,t+1} - r_f\right) + \alpha_{y,t}\left(r_{y,t+1} - r_f\right) + r_f. \tag{1.5}$$

The risky asset returns and the portfolio return are assumed to be lognormally distributed.[6] Thus defining $\delta_{i,t+1} \equiv \ln\left(1 + r_{i,t+1}\right)$ and $\delta_f \equiv \ln\left(r_f + 1\right)$ the modified portfolio return in $t+1$ is

$$\delta_{p,t+1} = \alpha_{x,t}\delta_{x,t+1} + \alpha_{y,t}\delta_{y,t+1} + \alpha_f\delta_f. \tag{1.6}$$

Defining u_i and σ_i^2 as mean and variance, the expected log excess return of the risky asset i is defined by

$$E_t\left(\delta_{i,t+1} - \delta_f\right) = E_t\left(\delta_{i,t+1}\right) - \delta_f \equiv \mu_i. \tag{1.7}$$

The labour income is also lognormally distributed and $l_{i,t+1} \equiv \ln w_{i,t+1}$ is the log labour income generated in sector i with expected mean μ_l and variance σ_l^2.

1.4.2 The Worker's Problem

To derive the investment decision of the working individual, we use an one horizon investment decision model. We consider a risk-averse individual with constant relative risk aversion coefficient $\gamma > 1$ close to Campbell and Viceira (2003).[7] The individual has an

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[5] The short-sale constraint is justified by the impossibility to trade claims against future labour income. Additionally, without short-sale the income effects on the capital market are isolated from possible wealth effects.

[6] A lognormal distribution results if the variable is the product of a large number of independent, identically distributed variables, in this model $\phi_{i,t}$. Therefore, the lognormal distribution is usually used to demonstrate asset return distribution. For further details see Aitchison and Brown (1973) or Pflaumer, Heine and Hartung (2001).

[7] Heaton and Lucas (2000b) use a similar life cycle model but with more than two periods. They set γ at 5 and 8 for a sufficient risk averse investor. On the other hand, Bertaut and Haliassos (1997) consider γ to take

initial endowment of wealth V_t in period t including the realised labour income in this period. In period t the individual decides which share of V_t to consume and which share α_i to invest in which industry. In particular, the realisation of the portfolio return in period $t+1$ in addition to $w_{i,t+1}$ is supposed to maximize the consumption of this individual with time preference parameter θ in period $t+1$:[8]

$$\max_{\alpha_{x,t},\alpha_{y,t}} E_t \left[\theta \frac{C_{t+1}^{1-\gamma}}{1-\gamma} \right]. \tag{1.8}$$

subject to the budget constraint and referring to (1.5)

$$C_{t+1} = V_t \left(1 + r_{p,t+1}\right) + w_{i,t+1}. \tag{1.9}$$

The worker chooses his asset allocation today to maximize his consumption tomorrow. He chooses his optimal portfolio to yield the highest possible return with respect to his risky labour income and the prevailing trade policy.

To obtain an analytical solution it is necessary to apply the log linear solution methods analogue to Cambell and Viceira (2003), and to extend them properly to the underlying model. Therefore, all involved quantities are assumed to be positive. We assume C_{t+1} is positive. In addition to the definitions already noted above, the following lowercase letters refer to the $\log$ of the uppercase variables.

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the value 3 for their benchmark life-cycle model without bequest. Furthermore, Heaton and Lucas (1997) derive different levels of risk aversion for CRRA investors.

[8] For the motivation to use this kind of utility function and its specific reaction to background risk see Gollier (2001).

First the log linearized portfolio return on wealth is computed from (1.5). Rearranging (1.5) and taking logs on both sides yields

$$\delta_{p,t+1} - \delta_f = \ln\left[1 + \alpha_{x,t}\left(\exp\left(\delta_{x,t+1}\right) - 1\right) + \alpha_{y,t}\left(\exp\left(\delta_{y,t+1}\right) - 1\right)\right]. \qquad (1.10)$$

Further implementing a second-order Taylor expansion with two variables around the point $\delta_{p,t+1} - \delta_f = 0$ results in [9]

$$\begin{aligned}
\delta_{p,t+1} &= \alpha_{x,t}\left(\delta_{x,t+1} - \delta_f\right) + \frac{1}{2}\alpha_{x,t}\left(1 - \alpha_{x,t}\right)\sigma_x^2 + \alpha_{y,t}\left(\delta_{y,t+1} - \delta_f\right) \\
&\quad + \frac{1}{2}\alpha_{y,t}\left(1 - \alpha_{y,t}\right)\sigma_y^2 + \alpha_{x,t}\alpha_{y,t}cov\left(\delta_{x,t+1}; \delta_{y,t+1}\right) + \delta_f.
\end{aligned} \qquad (1.11)$$

The next step is to log linearise the budget constraint. Hence both sides of (1.9) are divided by $w_{i,t+1}$ and logs are taken

$$c_{t+1} - l_{i,t+1} = \ln\left(\exp\left(v_t - l_{i,t+1} + \delta_{p,t+1}\right) + 1\right). \qquad (1.12)$$

Thus the log optimal consumption can be derived

$$c_{t+1} \approx g + \omega\left(v_t + \delta_{p,t+1}\right) + \left(1 - \omega\right)l_{i,t+1} \qquad (1.13)$$

with g and ω as log linearization constants.[10] $\omega \equiv \frac{\exp(\delta_p + v - l_i)}{1 + \exp(\delta_p + v - l_i)} < 1$ can be interpreted as the consumption elasticity with respect to financial wealth whereas $(1 - \omega)$ can be seen as the consumption elasticity with respect to labour income.

The log optimal future consumption is a weighted average of future financial wealth and future labour income, each weighted with the consumption elasticity with respect to financial wealth and labour income respectively. These weights are important for the further decision process because they also affect the importance of the different risk sources. For

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[9] For general discussions on this topic see Campbell and Viceira (2001) and Hardy and Walker (2003).

[10] g is a constant resulting from the linearization process and consitutes the consumption level.

instance, with $\omega > 0,5$ variations in the labour income have only a very small effect on consumption changes. On the other hand, changes in the financial wealth then have a big impact on the consumption decision. This can be a very interesting distinction for cases where financial wealth and labour income are negatively correlated in the final portfolio decision.[11]

To reach the optimal portfolio decision the first order condition of the problem has to be considered:[12]

$$E_t \left(\theta C_{t+1}^{-\gamma} \left(r_{i,t+1} + 1 \right) \right) = E_t \left(\theta C_{t+1}^{-\gamma} \left(r_f + 1 \right) \right). \tag{1.14}$$

The first order condition implies that the expected total return of the investment from the value of $C_{t+1}^{-\gamma}$ in industry x during period t has to be the same as the investment from the value of $C_{t+1}^{-\gamma}$ in industry y or the risk free asset in t. Precisely, foregone consumption in t must be compensated through an additional gain in financial wealth in $t+1$ independently of the chosen investment alternative. The first order condition is also log linearized and a second order Taylor expansion is implemented around the conditional means of c_{t+1} and $r_{i,t+1}$. Substituting (1.13) for c_{t+1} and rearranging results in

$$\mu_i + \frac{1}{2}\sigma_i^2 = \gamma \left[\omega \left(\alpha_{i,t}\sigma_i^2 + \alpha_{j,t}\sigma_{i,j} \right) + \left(1 - \omega \right) \sigma_{i,l} \right]. \tag{1.15}$$

Equation (1.15) is the logarithmic expectation about the excess return of asset i. The right hand side shows the different parts of it. Firstly, it depends on the risk of asset i itself and

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[11]   This impact of ω on the consumption decision gains even more on interest if the labour decision is endogenized, by Jermann (2002).

[12]   This first order condition is confirmed by the general consumption decision model under uncertainty by Drèze and Modigliani (1972).

the joined risk of asset i and asset j. This is weighted by the consumption elasticity with respect to capital income. The second part is the effect caused by the joined risk between asset i and the labour income. This part is weighted by the consumption elasticity with respect to labour income. Furthermore, the risk aversion of the investor weighs both parts additionally.

For simplicity, we analyse investment decisions in industry x. These results are analogue for investment decisions in industry y. Solving (1.15) for $\alpha_{x,t}$ leads to the asset allocation in industry x

$$\alpha_{x,t} = \frac{1}{\gamma\omega}\frac{\mu_x + \frac{1}{2}\sigma_x^2}{\sigma_x^2} - \frac{\alpha_{y,t}\sigma_{x,y}}{\sigma_x^2} - \frac{(1-\omega)}{\omega}\frac{\sigma_{x,l}}{\sigma_x^2}. \tag{1.16}$$

In (1.16) the optimal decision $\alpha_{x,t}$ is a simultaneous decision with $\alpha_{y,t}$. Substituting $\alpha_{y,t}$ by using (1.4) this can be rewritten as

$$\alpha_{x,t} = \frac{1}{\gamma\omega}\frac{\mu_x + \frac{1}{2}\sigma_x^2}{\sigma_x^2 - \sigma_{x,y}} - \frac{f\sigma_{x,y}}{\sigma_x^2 - \sigma_{x,y}} - \frac{(1-\omega)}{\omega}\frac{\sigma_{x,l}}{\sigma_x^2 - \sigma_{x,y}}. \tag{1.17}$$

Equation (1.17) is the share of asset x the worker chooses to hold in his portfolio. Here

$f \equiv (1 - \alpha_{f,t})$. Hence, f indicates the total proportion of risky assets in the portfolio.[13] Obviously the optimal asset allocation for investments in industry x can be divided into three components. The first term on the right corresponds to the decision of an investor in the standard mean-variance analysis.[14] To see this connection more clearly it is important

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[13]   In turn, $1 - f$ states the proportion of the risk free asset in the chosen portfolio.

[14]   For a detailed derivation of the mean-variance method see Markowitz (1987).

to recall an important property of a lognormal distributed variable, namely

$$\log E_t\left(r_{i,t+1}+1\right) = E_t\log\left(r_{i,t+1}+1\right) + \frac{1}{2}var\log\left(r_{i,t+1}+1\right). \qquad (1.18)$$

The isolated portfolio decision - in this case given a specified risk-aversion - depends mainly on the mean and variance ratio of the log excess return of asset x. In the present case, the second risky asset and the labour risk affect $\alpha_{x,t}$ too.

The impact of the second risky asset - the second term on the right hand side of equation (1.17) - is not unambiguous. Under the assumption of a positive correlation between the risky assets in the first term, the joined risk of the two risky assets mitigates the pure risk of asset x (positive direct impact). With negative correlations between the risky assets the joined risk enforces the risk effect of asset x (negative direct impact). This joined risk effect also impacts the labour risk hedge component of the optimal asset allocation for asset x.

The additional risk through the implementation of a second asset y does not necessarily lead to a rebalancing of the portfolio between asset x and y. Independent from the correlation of the two risky assets, the additional risk may also decrease the shares in x and y and raise the share invested in the risk free asset. Gollier and Schlee (2006) show that in a two-risky-asset case the increase of the expected dividend of one asset does not necessarily always cause an increase in the demand for this asset. Therefore, the correlation between the two risky assets is irrelevant.

The third part in equation (1.17) constitutes the impact of the labour income and risk in the asset choice. Analogue to the joined asset risk, the correlation between the asset x and the labour income determines this effect. If the worker works in industry x the third

component of equation (1.17) reduces the asset demand. A negative correlation between industry x and the worker's income increases the demand of asset x.

1.5 Risk Diversification under Protectionist Trade Policy

In this section we introduce an exogenous tariff in industry x. Further, we derive the portfolio decision of the worker and analyse a possible hedge of the labour income risk. Following Feeney and Hillman (2004), an unrestrained access to asset markets lowers the individual demand for a protectionist trade policy. If individuals have unrestricted access to complete asset markets then their demand for other security provisions as protectionist trade policy diminishes. Furthermore, they show that even in a state of an imperfect asset market, and therefore partly restricted risk diversification, the demand for a protectionist trade policy is reduced. In this situation, lobbying for a tariff only occurs if the import competing sector is sufficiently large. Conversely, the introduction of a protectionist trade policy is supposed to lead to less use of asset markets.

With negatively correlated profit of the industry sectors, Cassing (1996) finds that the introduction of a tariff in one sector induces a concentration of the investments in the protected sector. In contrast to the present analysis, he considers an investor who only owns capital income.

To analyse these results we introduce an exogenous trade policy in the model above. In period $t + 1$ a positive tariff on import goods is imposed in industry x, $\tau_{x,t+1}$. Hence the relative price in the home country for goods produced in industry x changes from $p_{x,t+1}$ to $p_{x,t+1}(1+\tau_{x,t+1})$ and for goods produced in industry y from $p_{y,t+1}$ to $\frac{p_{y,t+1}}{(1+\tau_{x,t+1})}$ respectively.

The means of the log excess return of the risky assets depend on the prices of the respective goods. Consequently, the variances and covariances are also affected by trade policy. Thus, the portfolio shares depend indirectly on trade policy.

To analyse the tariff impact on the asset allocation of the worker in detail we derive the total differential of the asset demand. It shows that the impact of trade policy on the asset demand for asset x is not unambiguous[15]

$$\frac{\partial \alpha_{x,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{x,t}}{\partial \mu_x}}_{(+)} \underbrace{\frac{\partial \mu_x}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_x^2}}_{(-)} \underbrace{\frac{\partial \sigma_x^2}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,y}}}_{(\,)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{(\,)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,l}}}_{(\,)} \underbrace{\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}}}_{(\,)}. \qquad (1.19)$$

In (1.19) the tariff impact on the mean and the variance as well as the demand reaction of these two variables can be signed unambiguously. The effects on the asset covariance and the asset labour covariance can go either way. Thus, the sign of the reaction cannot be determined. Obviously, the first two components of $\alpha_{x,t}$ both depend positively on the tariff. In the case of the mean this direction of the dependency might be expected but for the variance of the return of asset x this is somewhat surprising and will be discussed later on.

The positive impact of the tariff in industry x on the mean of asset x

$$\frac{\partial \mu_x}{\partial \tau_{x,t+1}} = q_x \frac{r_{x,t+1}}{r_{x,t+1}^\tau + 1} > 0 \qquad (1.20)$$

results in a higher capital payment out of a higher profit. This is intuitive as the protected industry faces higher output prices on the market for consumption goods. Precisely, the tariff impact on μ_x depends on the weighted ratio between the capital income without a tariff and the capital wealth in case of a tariff. This in turn leads to a higher return for the

_____
[15]   Analogue for asset y.

capital for every $\phi_{x,t+1}$. However, the marginal impact of a rising tariff on μ_x decreases. Referring to (1.17) $\alpha_{x,t}$ increases unambiguously in the mean. Hence, the cumulative effect of the trade policy and the expected mean of asset x on the asset demand for asset x is positive.

The tariff impact on the variance of asset x is

$$\frac{\partial \sigma_x^2}{\partial \tau_{x,t+1}} = 2q_x \left(1 - q_x\right) \frac{r_{x,t+1}}{r_{x,t+1}^\tau + 1} \delta_{x,t+1}^\tau > 0. \tag{1.21}$$

Since q_x is always lower than one inequation (1.21) is always fulfilled. The tariff impact is similar to the impact on μ_x. It is weighted with the log dividend paid in industry x in the state of tariff and $(1 - q_x)$. So the variance for asset x rises with the tariff in sector x. Again the marginal impact of $\tau_{x,t+1}$ on σ_x^2 decreases. To understand this relation it is important to keep in mind that the economy is open and small. The only variations in the home country result from the productivity shocks $\phi_{x,t+1}$ and the introduction of a tariff in industry x which reinforces the existing productivity shock.

Actually, the impact of the asset risk σ_x^2 on the share of asset x in the portfolio $\alpha_{x,t}$ is not always unambiguous. The size of the covariance and the risk aversion determine the sign of the reaction of $\alpha_{x,t}$ on σ_x^2.[16] As we assume a highly risk averse investor, the cases with an increasing asset demand in σ_x^2 are ruled out.[17] Thus, in the following analysis a decreasing $\alpha_{x,t}$ in σ_x^2 is assumed.[18]

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[16]   All possible constellations are summarized in table 1.1 in Appendix 1.7.

[17]   This assumption is justified mathematically. A high γ rules out a positive reaction of the asset demand as a result of an increasing variance.

[18]   Here the empirical evidence is rather interesting. Regardless of the correlation between the asset returns Goetzmann and Kumar (2004) find empirical evidence for investors' behaviour in the opposite directions. These investors reduce their total portfolio risk by adding more risky assets to their portfolio. In particular, Goetzmann and Kumar (2004) use different measures of diversification. One of these measures, the nor-

For a complete solution of (1.19) the impact of the trade policy on the covariance

$$
\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}} = \rho \sigma_x^2 \left[\frac{r_{y,t+1}^\tau}{r_{y,t+1}^\tau + 1} \delta_{y,t+1}^\tau \right] \left(q_y^2 - q_y \right) - \rho \sigma_y^2 \left[\frac{r_{x,t+1}^\tau}{r_{x,t+1}^\tau + 1} \delta_{x,t+1}^\tau \right] \left(q_x^2 - q_x \right) \gtrless 0
$$

$$(1.22)$$

is needed. It consists of the difference between the weighted log excess returns of both assets. The weights are the respective shock probability and the variance of the respective opposite asset. In particular, this effect depends on the relation of the variances of the assets, on probability of the productivity shock in each industry, the relative prices of the two goods and finally on the factor intensity in the respective industry. However, with the underlying assumption most of these influences are determined. Good x is assumed to be the labour intensive good. Hence, the factor intensity ratio is biased towards asset x. Nevertheless, the relation of the productivity shocks can turn the tariff impact on the covariance. The underlying assumption of the Heckscher-Ohlin Model is that the industry with a productivity advantage will be the exporting industry. Consequently, the productivity-shock relation can be determined more definite. As industry y is the exporting industry, we only analyse the states with a higher productivity shock for industry y than for industry x. Thus, the probability q_y for a positive productivity shock for industry y is supposed to be higher than the probability q_x of a positive productivity shock in industry x. Furthermore, the vulnerability of the industries to economic shocks is a crucial impact factor too.[19] Industry y

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malised version of the portfolio variance, shows two possibilities to reduce the risk of an individual portfolio. The first possibility of risk reduction is to increase the number of assets in the portfolio; the second is to choose assets according to their negative correlations.

[19]   The shock vulnerability is high if the probability for one specific shock is low. Hence, there are many possible shocks to occur and the realization of one specific shock is rather uncertain. Additionally, both asset variances increase in the shock probability as long as the shock probability is lower than 0.5. As soon as the shock probability is higher than 0.5 the asset variances decrease in the shock probability. However, for any given shock probability the asset variances do not vary.

is taken as benchmark. The shock exposure for industry y is low and does not change for

this analysis. Variations of the shock exposure in industry x are measured against indus-

try y. The ratio between these vulnerabilities determines the direction of the tariff impact

on the asset covariance. Diverging shock vulnerability, especially a low one for industry y

and a high vulnerability in industry x enhance a negative tariff impact on the covariance.

In this case, the decreasing risk caused by tariff impact in industry y is weighted higher

than the additional risk increase in industry x. This effect diminishes and switches com-

pletely for converging shock vulnerability in both industries. All these considerations are

valid with a positive correlation of the industries. A negative correlation between the two

industries turns the effects in the opposite direction. The size of σ_x^2 and the total risk share

in the portfolio f influence the demand reaction on the asset covariance.[20]

Lastly the covariance of asset x and the labour income is analysed

$$\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}} = \sigma_l^2 \frac{r_{x,t+1}}{r_{x,t+1}^\tau + 1} \delta_{x,t+1}^\tau + \sigma_x^2 \frac{1}{1 + \tau_{x,t+1}} l_{x,t+1} \gtrless 0. \qquad (1.23)$$

As long as the labour income is generated in the protected industry the tariff impact on $\sigma_{x,l}$

is always positive. This might be surprising, but when referring to the tariff impact on the

risk of asset x and the labour income respectively the positive impact on $\sigma_{x,l}$ is confirmed.

Both separated risks increase in the tariff. Hence, if they are positively correlated it is obvi-

ous that the covariance is also positively affected by the tariff.[21] Moreover, the tariff impact

on $\sigma_{x,l}$ is affected by the same factors as the asset covariance: correlation between the as-

sets, productivity shocks, relative prices and factor intensity. The asset demand reaction

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[20]   See table 1.2 in Appendix 1.7 for possible outcomes of $\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,y}}$.

[21]   Krebs et al. (2005) instead find empirical evidence that in an economic boom the labour risk decreases
with a reduced tariff rate. But the overall evidence for this risk behaviour is rather weak.

on $\sigma_{x,l}$ depends further on the correlation between the asset return and the labour income. Thus, a positive correlation between these variables reduces the respective asset demand and a negative correlation enforces it.

Above all, the appearance of an idiosyncratic labour income risk reinforces the demand-dampening effect of the variance if a risk-averse investor is assumed. Based on the chosen utility function this coincides with the statement from Gollier (2001) that an independent background risk raises the aversion against the other risk source if the absolute risk aversion is decreasing and convex. Empirical evidence for these findings, especially with uncertain labour income as the additional risk source, is found by Heaton and Lucas (2000a) and (2000b).

1.5.1   Poor Worker

In this, section two different scenarios with two respective variations are analysed. Because the two risky assets - and therefore the two industries - are positively correlated, the analysis of labour income generated in the non-protected industry y is neglected. As our main interest is the working individual, we assume the portfolio risk to be low. A worker who depends strongly on his working income is not willing to bear a huge amount of risk.[22] Hence, the total risk share in the portfolio is $f < \frac{1}{2}$.

Positively Correlated Sectors

Scenario Ia: worker in protected industry, similar shock variation for both industries

We assume a positive correlation between the two industry sectors.[23] Furthermore, a low total risk share in the portfolio $f < \frac{1}{2}$ is given. As a result of the assumptions for this scenario, three more derivations can be signed and (1.19) changes to

$$\frac{\partial \alpha_{x,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{x,t}}{\partial \mu_x}}_{(+)} \underbrace{\frac{\partial \mu_x}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_x^2}}_{(-)} \underbrace{\frac{\partial \sigma_x^2}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,y}}}_{(+)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,l}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}}}_{(+)}. \qquad (1.24)$$

At first glance it might be surprising that the asset demand reacts positively to the asset covariance, but on a closer look it shows that this reaction results from a common

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[22]   See for example Bodie et al. (1992) for the willingness of risk bearing in dependence on the possibility of labour supply variation.

[23]   In particular, the positive correlation of the asset returns in the two different industries can result from country shocks and a stronger sensitiveness of both assets to these shocks than to industry specific shocks. Thus, the returns in both industries are synchronized to a certain level. The significance of different shocks (industry, country, global) and their impact on the return for different industries are analysed for example in Brooks and Del Negro (2004) and (2005). For concrete examples see Costello (1993). She finds positive production and shock correlation between manufacturing industries for different countries.

portfolio-allocation motive. The worker has similar preferences concerning financial and labour income. Hence, with a sufficiently high industry risk he reduces his portfolio risk by increasing the number of assets in his portfolio.[24] In particular, a worker with a low risk share $f < \frac{1}{2}$ in his portfolio wants to substitute increasing risk in industry x by shares off a more stable industry.[25],[26]

The asset covariance is negatively affected by the tariff in industry x. This effect is caused by a relatively predictable development of industry y and a high shock vulnerability in industry x. With the given shock probability the demand for asset x decreases in the asset covariance. The tariff affects the asset-labour covariance positively. As the worker works in industry x, his labour risk is closely connected to the industry risk. Thus, if the risk for the whole industry increases then his labour risk goes up too. All in all, there are three demand decreasing effects and one demand increasing effect. The increased expected excess return of asset x enforces the asset demand. However, with a high shock exposure the dampening impact of the asset risk σ_x^2 obviously compensates this positive effect. Consequently, the demand for asset x decreases in the tariff.

In the next step, the share α_y is analysed. A direct hedge of the labour risk is not possible as a positive correlated labour income risk is assumed. As a consequence, analogue to industry x, the asset-labour covariance increases in the tariff. So a hedge can only take place if the asset covariance effect impacts the demand for asset α_y positively. Thus $\alpha_{y,t}$

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[24]   For empirical evidence of this investment behaviour see for example Goetzmann and Kumar (2004) or Massa and Simonov (2006) for the familiarity motive. Additionally, Juillard (2004) shows this investor behaviour in a dynamic model of international portfolio diversification.

[25]   See table 1.3, column three in Appendix 1.7.

[26]   An additional preference bias towards labour income supports this result.

should also rise in the asset covariance.

$$\frac{\partial \alpha_{y,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{y,t}}{\partial \mu_y}}_{(+)} \underbrace{\frac{\partial \mu_y}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_y^2}}_{(-)} \underbrace{\frac{\partial \sigma_y^2}{\partial \tau_{y,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{x,y}}}_{(+)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{y,l}}}_{(-)} \underbrace{\frac{\partial \sigma_{y,l}}{\partial \tau_{x,t+1}}}_{(+)}. \qquad (1.25)$$

Again, three demand decreasing and one demand increasing effects arise in industry y. Firstly, we analyse the intra-industry effects. In contrast to the demand for asset x, the decreased mean now compensates the decreasing risk in industry y. Given that industry y is already relatively stable, a further decrease in risk drives the asset demand much weaker than an increasing expected excess return. Both inter-industry effects decrease the demand for asset y. The worker neglects the labour risk hedge motive because both assets are positively correlated with the labour income. Based on the given shock vulnerability of both industries, the tariff reduces the common volatility of both industries. These two inter-industry risk sources compensate the remaining demand increasing effect caused by the reduced volatility in industry y. As a consequence, the demand for asset y decreases in the tariff.

The worker in industry x faces a stronger risk than without a tariff. He reduces his share of asset x in his portfolio. In industry y the risk is damped. Usually, one might expect an increase in his share of asset y. Yet, the industries are positively correlated. Thus, a hedge of the industry x risk is not possible by rebalancing the portfolio towards asset y. Therefore, in the scenario with low total risk, positive asset correlation, labour income generated in the protected industry and a high shock exposure in industry x, we find a decreased exploitation of the asset market. Moreover, there is no possible hedge of the labour risk even though there is no investment concentration.

Scenario Ib: worker in protected industry, diverging shock variation for both industries

A change in the shock vulnerability of industry x alters the tariff impact on the asset co-variance. A decreasing shock vulnerability reduces the volatility of industry x. Thus, with an unchanged exposure in industry y the tariff impact on the asset-covariance shifts from negative to positive. Precisely, the introduction of a tariff in industry x increases the asset-covariance. The asset-labour covariance compensates the asset covariance impact. With the still higher shock exposure in industry x the intra-industry variations are stronger drivers for the asset demand than the inter-industry variations. Hence, the demand for asset x is more sensitive to the risk increase and the variations in the labour income than to the reduction of the risk in industry y and the increasing mean in industry x. The remaining effects caused by the tariff introduction stay unchanged. Overall, this scenario leads to weaker results. Even though there is a tendency towards an increase in the asset demand, a definite reaction of the demand for asset x is not possible to determine.

Let us turn to the tariff impact on the demand for asset y. Similar to the demand for asset x, the reaction of the asset covariance changes and all other effects stay unchanged. Unlike in industry x, both covariances now represent inter-industry effects. Nevertheless, the tariff impact on the asset covariance compensates the impact on the asset-labour covariance. Obviously, the demand for asset y cannot be determined in case of a positive tariff impact on the asset covariance.

Repeating the analysis with a stronger decrease in shock vulnerability for industry x leads to more definite results, at least for industry x. With relatively insensitive industry

x the demand for asset x increases in the tariff. The tariff of the expected excess return compensates the impact on the industry risk. The other effects do not change for any industry.

The total asset demand cannot be determined unambiguously. There is a slight tendency towards a portfolio bias in favour of asset x. This can be justified by the reduction of the portfolio risk by increasing the number of assets. Though the concentration statement of Cassing (1996) is confirmed only warily, at least it can not be rejected. In addition, the results do not support decreased asset market exploitation as might be assumed by following Feeney and Hillmann (2004). Finally, there is no possible labour risk hedge found in this scenario either.

Here, the additional risky labour income changes the results slightly. Without the labour risk the demand for asset y also increases in the tariff. So there is no investment concentration to be found. Furthermore, the labour risk diminishes the exploitation of the asset market slightly.

To conclude, we can say that independent from the total risky share f in the portfolio a hedge of the labour income is hardly possible as the two industries are positively correlated. Though an investment concentration cannot be confirmed yet, the asset market exploitation shows a slight tendency towards a reduction, as a tariff is implemented in industry x.

Negatively Correlated Sectors

In the case of negatively correlated sectors, a change in the labour income correlation is very interesting. The following two scenarios with two respective variations are discussed.

Scenario IIa: worker in protected industry x, similar shock variation for both industries

Here a demand decreasing effect arises for asset x. This is very intuitive as it does not matter whether the exposure to the intra-industry effects is higher than for inter-industry effects. The tariff introduction boosts the joined variation of both industries.

$$\frac{\partial \alpha_{x,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{x,t}}{\partial \mu_x}}_{(+)} \underbrace{\frac{\partial \mu_x}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_x^2}}_{(-)} \underbrace{\frac{\partial \sigma_x^2}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,y}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,l}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}}}_{(+)}. \qquad (1.26)$$

Consequently, the tariff impact on the asset covariance as well as on the labour asset covariance dampens the demand for asset x. Furthermore, the tariff impact on the industry risk exceeds the increased expected excess return for industry x. The overall effect of a tariff introduction in industry x decreases the demand for the share of industry x.

In the case of a positive tariff impact on the asset covariance, the demand for asset y decreases.

$$\frac{\partial \alpha_{y,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{y,t}}{\partial \mu_y}}_{(+)} \underbrace{\frac{\partial \mu_y}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_y^2}}_{(-)} \underbrace{\frac{\partial \sigma_y^2}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{x,y}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{y,l}}}_{(+)} \underbrace{\frac{\partial \sigma_{y,l}}{\partial \tau_{x,t+1}}}_{()}. \qquad (1.27)$$

The impact on the labour asset covariance in industry y does not change. Similar to industry x, both covariances decrease the demand for asset y. As the overall conditions remain unchanged, $\alpha_{y,t}$ decreases in the total inter-industry effect. However, the total intra-industry

effect is the same as above. The tariff introduction in industry x reduces the demand for asset y.

In the scenario with a high volatility industry x, the total asset demand is diminished by the tariff implementation in industry x. The worker reduces the share of asset x in his portfolio as a consequence of the strengthened risk in this industry. With the stronger co-variance (less negative), the hedging possibility diminishes. Thus, the worker also reduces his share of asset y. Therefore, we confirm a definite loss on hedging possibilities for the labour risk, accompanied by a reduction in the asset market exploitation. It is clear that there is no investment concentration as both asset demands decrease in the tariff. In this last case, the additional labour risk does not change but strengthens the results.

All in all, for scenario IIa with a low total risky portfolio share we find a loss of diversification possibilities caused by the tariff introduction. As a consequence of the higher risk in both industries, the labour risk hedge possibilities are reduced and the total asset demand decreases by the tariff introduction in industry x.

Scenario IIb: worker in protected industry, diverging shock variation for both industries

Now the hedging motive becomes more important. Hence, with a rather high shock expo-sure of industry x, two demand increasing and two demand decreasing tariff effects face each other. At first, the three intra-industry effects are analysed. Two of them are demand decreasing and only the effect of the increased expected excess return pushes the demand of asset x up. This effect is slightly weaker than the increased industry risk. As long as the volatility of the industry x is high, the increased industry risk caused by the tariff introduc-

tion outweighs the increased expected excess return. Accordingly, the total intra-industry effect decreases the demand of asset x.

The demand reaction on the asset covariance changes is high as long as the total risky portfolio share still exceeds $\frac{1}{2}\frac{1}{\gamma\omega}$. However, with the low total risk share this weight is very small. Nevertheless, the demand for asset x reacts more sensitively to changes in the labour asset covariance than to variations in the asset covariance. The labour risk becomes more important as the correlations of labour risk with asset x and industry y with asset x are contrary. Additionally, as we assume a working individual, we implicitly assume a slightly higher consumption elasticity referring to labour income rather than to financial income. Consequently, in the present scenario the worker weighs labour effects more than the inter-industry effects.[27] The labour asset covariance increase in the tariff is stronger than the asset covariance decrease. Hence, the total effect from the two covariances on the asset demand is negative. Thus, a tariff introduction in industry x reduces the demand for $\alpha_{x,t}$. Assuming a decreasing volatility for industry x dilutes the tariff impact on α_x.

Under the assumption of a high shock exposure in industry x and a relatively invulnerable industry y, the labour asset covariance as well as the asset covariance are negatively affected by the tariff. In contrast to industry x, the tariff effect on the labour asset covariance is weaker than on the asset covariance. The direct link between the two industries influences the demand decision more strongly than the additional labour risk.[28] So the

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[27]   See Juillard (2004) for a similar argumentation. He finds that a high liquid wealth-labour income ratio influences the portfolio allocation towards a financial hedge, and with a low ratio, a labour risk hedge gains on weight.

[28]   Shock invulnerability is interpreted as a relatively low shock probability in combination with a small variance of the respective industry return.

tariff boosts the inter-industry variations. Therefore, these inter-industry effects cause a raising demand for asset y.

Analogue to the scenario with positive correlated industries, the effect of μ_y compensates the effect of σ_y^2. As the total risk share falls below one half, the strength of the variance effect diminishes and the decreasing mean effect rises again. Hence, the intra-industry effect is negative. Consequently, the overall reaction of $\alpha_{y,t}$ in $\tau_{x,t+1}$ is ambiguous.

To sum up, in a scenario with a low total risky portfolio share, negative asset correlation, risky labour income generated in industry x and a high volatility industry x, we find a very slight tendency towards a decreasing total asset demand. Therefore, the conclusions of reduced asset market use, no possible labour hedge and no investment concentration are rather weak. In comparison to a situation without risky labour income, the tariff impacts on the total asset demand and therefore the consequences are reverted.

Scenario IIIa: worker in unprotected industry y, similar shock variation for both industries

In the following, the reaction of the asset demand to a tariff introduction for a worker who works in the unprotected industry is analysed. This scenario shows the tariff impact with similar shock vulnerability for both industries. First, we analyse the impact on $\alpha_{x,t}$.

$$\frac{\partial \alpha_{x,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{x,t}}{\partial \mu_x}}_{(+)} \underbrace{\frac{\partial \mu_x}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_x^2}}_{(-)} \underbrace{\frac{\partial \sigma_x^2}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,y}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,l}}}_{(+)} \underbrace{\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}}}_{()}. \qquad (1.28)$$

Hence, both covariances in this industry increase in the tariff. Again the asset covariance dominates the labour asset covariance, and therefore the total inter-industry effect of the

tariff is negative. In contrast, the intra-industry effect remains unchanged. So the demand for asset x in dependence of the tariff in industry x goes down.

In industry y the asset covariance increases in the tariff and the labour asset covariance shows the same effect as before.

$$\underbrace{\frac{\partial \alpha_{y,t}}{\partial \tau_{x,t+1}}}_{} = \underbrace{\frac{\partial \alpha_{y,t}}{\partial \mu_y}}_{(+)} \underbrace{\frac{\partial \mu_y}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_y^2}}_{(-)} \underbrace{\frac{\partial \sigma_y^2}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{x,y}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{(\,)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{y,l}}}_{(-)} \underbrace{\frac{\partial \sigma_{y,l}}{\partial \tau_{x,t+1}}}_{(-)}. \qquad (1.29)$$

Again, the labour asset covariance dominates the effect of the asset covariance. Thus, we find a demand increasing effect. Similar to industry x, the low total portfolio risk distorts the demand dependency towards the mean variations. Hence, there is a negative intra-industry impact on the demand for asset y. Again, a definite overall tariff impact on the demand of asset y cannot be determined. Only a small increase might be possible. Now the hedging possibility is diminished and we find no definite reaction in the asset allocation of the worker.

Referring to the tariff impact in industry x and industry y with a low portfolio risk and a stronger risk increase in industry x than risk decrease in y, no unambiguous direction of the total asset demand is determined. An income hedge is not clearly possible. Above all, we can neither confirm nor reject any statement about asset market exploitation and investment concentration.

Summarising for the scenario with low portfolio risk, negative asset correlation and labour income generated in the unprotected industry, we find that a sufficiently strong risk increase in industry x can diminish the asset market exploitation and therefore reduces the diversification possibilities. This in turn leads to reduced hedge of the labour risk.

Scenario IIIb: worker in unprotected industry y, diverging shock variation for both industries

This variation of scenario IIIa assumes diverging shock vulnerability for the two industries. As the tariff impacts on the respective components of the asset demand remain unchanged, we start analysing the compensation effects between the components.

The analysis emphasizes the tariff impact on the two covariances. The remaining effects stay unchanged. Under the assumption that only small shocks hit industry x, both covariances are negatively affected. The tariff impacts balance each other. However, as the labour risk and asset y are both negatively correlated with asset x, the compensation effect changes in comparison to the previous scenario. Thus, the asset covariance dominates the labour asset covariances by influencing the demand of asset x. Hence, the total inter-industry effect increases the demand for asset x. As a second step, we analyse the intra-industry effects. The low total risk share in the portfolio influences the compensation effect significantly. Therefore, the demand reacts more strongly to changes in the industry risk than to changes in the expected excess return. The intra-industry effect on the asset demand is negative. Thus, a definite determination of the reaction of α_x to a tariff introduction in industry x is not possible. Nevertheless, with a converging volatility of industry x tending towards less shock exposure enforces these results. The expected excess returns gains on weight. In this case, a tariff introduction implies an increasing demand.

Similar to the asset demand in industry x, the signs for the labour income risk correlation change in industry y. The tariff impact on the asset covariance as well as on the labour asset covariance is negative. Even though the tariff impact on the expected excess

return is negative, the demand of asset y increases in $\tau_{x,t+1}$. Especially with a relatively stable industry x, asset x works as a hedging instrument now. The negative tariff impact on the covariance even enforces this effect. Hence, the worker increases his share of asset x because of the increased return and as a result of the hedging improvement. Then the worker increases his amount of asset y. The risk reduction in all three risk components compensates the decreased return of this asset y. Therefore, he can reduce his portfolio risk by increasing the number of asset y. Thus, the total effect of the tariff increases the overall asset demand slightly. In a scenario with low total risk, negative asset correlation, labour income generated in the non-protected industry and a negative tariff impact on the asset covariance, a hedge of the labour income is definitely possible. We find an increasing total asset demand which is accompanied by a marginal investment concentration in the unprotected industry.

1.5.2   Wealthy worker

In the previous scenarios, the underlying assumption was a worker who depends strongly on his labour income. Additionally, he was unwilling to bear a huge amount of risk in his portfolio. Now these assumptions are loosened. For the following scenarios, the worker is considered to be wealthy and willing to handle a high risk share in his portfolio.

Positively Correlated Sectors

Scenario IVa: wealthy worker in protected industry x, similar shock variation for both industries

In this scenario the total risky share is high $f > \frac{1}{2}$ and $\alpha_{x,t}$ decreases in $\sigma_{x,y}$. This leads to

$$
\frac{\partial \alpha_{x,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{x,t}}{\partial \mu_x}}_{(+)} \underbrace{\frac{\partial \mu_x}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_x^2}}_{(-)} \underbrace{\frac{\partial \sigma_x^2}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,y}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,l}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}}}_{(+)}. \qquad (1.30)
$$

It is obvious from (1.17) that the derivation of the asset demand for asset x with respect to the covariance between asset x as well as to the labour income is negative as long as the correlation between the two industries is positive. Thus, an increase in the labour income risk reduces the demand for asset x. Furthermore, with a positive correlation between the labour income and asset x the labour asset covariance is positively affected by the tariff: $\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}} > 0$.

Therefore, the total direct effect of the risky labour income on the demand for asset x is negative. This can be explained through the additional risk source argumentation by Bodie et al. (1992) and Gollier and Schlee (2004). This argumentation will even be enforced by the positive correlation between the labour income and the return of asset x.

With the total risk above one half

$$f > \frac{1}{2}\frac{1}{\gamma\omega} \tag{1.31}$$

is satisfied. Hence, the demand for asset x reacts more sensitively to changes between the industries ($\sigma_{x,y}$) than to intra-industry changes (σ_x) and the decreasing $\sigma_{x,y}$ stimulates the demand for asset x more than the increasing risk of asset x decreases it. However, the demand decrease caused by the enforced labour income variations exceeds the demand raising effect through the decreased common industry risk. Additionally, the increased expected excess return is compensated by the reduced isolated industry risk.[29] Overall, the tariff introduction in industry x implies a rather decreasing demand for asset x. If one allows for a decreasing volatility of industry x with respect to economic shocks, the demand for asset x reacts positively to a tariff introduction. In this case, the increased expected return gains on weight and exceeds the diminished industry risk.

As long as the two risky assets are positively correlated there is also a positive correlation between the risk of asset y and the labour income risk. Hence, a direct hedge is not possible. However, a risk reduction in terms of Goetzmann and Kumar (2002) is possible by increasing the number of the shares contained in the portfolio. So the demand for asset y does not necessarily decrease in the tariff

$$\frac{\partial \alpha_{y,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{y,t}}{\partial \mu_y}}_{(+)}\underbrace{\frac{\partial \mu_y}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_y^2}}_{(-)}\underbrace{\frac{\partial \sigma_y^2}{\partial \tau_{y,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{x,y}}}_{(-)}\underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{y,l}}}_{(-)}\underbrace{\frac{\partial \sigma_{y,l}}{\partial \tau_{x,t+1}}}_{()}. \tag{1.32}$$

---

[29] Assuming a strong consumption elasticity referring to wealth would strengthen the observed result. As this section studies a relatively wealthy worker, the assumption of high consumption correlation with respect to wealth is justified. This worker is willing to bear a high risk share in his portfolio. Thus he does not depend as much on his working income compared to the worker in the previous section with a low portfolio risk share.

The lower direct risk of this asset and the decreasing effect on the asset covariance can enforce a higher asset demand. In contrast to asset x, the expected mean of the log excess return of asset y decreases in the tariff. So, in comparison to the asset shifting in the state without $\tau_{x,t+1}$, the risk reduction has to compensate not only the labour risk but also a lower expected asset return. Analogue to the impact on the asset covariance, the decreased risk in industry y also induces a reduction in the asset labour covariance referring to industry y. Thus, all three risk effects pull in the same direction and they compensate for the reduced expected excess return of asset y. So, in spite of the positive correlated labour risk and the tariff introduction, the demand for asset y increases with a tariff introduction in industry x.

Consequently, in a scenario with high total risk, positive asset correlation, risky labour income generated in industry x and a stronger risk decrease in industry y than risk increase in industry x, the introduction of a tariff in industry x does not cause a rebalancing of the portfolio towards asset x. In particular, there is no investment concentration in the protected industry as Cassing (1996) states. Furthermore, there is a possible hedge of the labour income in terms of Goetzmann and Kumar (2002). However, we find no confirmation of decreased asset market exploitation as a result of the tariff-introduction as Feeney and Hillman (2004) would suggest. By assuming an exogenous state of the asset market, they neglect the influence between the two industries on the individual investment behaviour. The authors consider only the state of the asset market and the corresponding tariff. We take mutual relationship between the two industries into account and allow the worker

to adjust his portfolio according to the present tariff and the caused variation in the two industries.

Scenario IVb: worker in protected industry x, diverging shock variation for both industries

For the sake of completeness, a positive tariff impact on the asset covariance is considered. In this case, the demand for both risky assets decreases in the tariff. Again, the risky labour income has no significant influence on the results.

Negatively Correlated Sectors

Scenario Va: worker in industry x, similar shock variation for both industries

Now the scenarios are analysed with negatively correlated industries. The impact of the tariff on the asset risk and the expected excess return remains unchanged.

$$\frac{\partial \alpha_{x,t}}{\partial \tau_{x,t+1}} = \underset{(+)}{\frac{\partial \alpha_{x,t}}{\partial \mu_x}} \underset{(+)}{\frac{\partial \mu_x}{\partial \tau_{x,t+1}}} + \underset{(-)}{\frac{\partial \alpha_{x,t}}{\partial \sigma_x^2}} \underset{(+)}{\frac{\partial \sigma_x^2}{\partial \tau_{x,t+1}}} + \underset{(+)}{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,y}}} \underset{()}{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}} + \underset{(-)}{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,l}}} \underset{(+)}{\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}}}. \qquad (1.33)$$

The tariff impact on σ_{xy} turns positive with the higher volatility of industry x. Even though the inter-industry variations gain on importance, still the exposure to increasing risk in the own industry x exceeds this demand enhancing tariff impact. Even though the effect is weak, the demand for asset x decreases in the tariff.

The tariff impact on the asset covariance and on the labour asset covariance determines the effect on the demand of asset y:

$$\frac{\partial \alpha_{y,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{y,t}}{\partial \mu_y}}_{(+)} \underbrace{\frac{\partial \mu_y}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_y^2}}_{(-)} \underbrace{\frac{\partial \sigma_y^2}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{x,y}}}_{(+)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{y,l}}}_{(+)} \underbrace{\frac{\partial \sigma_{y,l}}{\partial \tau_{x,t+1}}}_{()}. \qquad (1.34)$$

Moreover, as $\sigma_{y,l}$ now increases in $\tau_{x,t+1}$ the demand for asset y decreases in the tariff too. The two demand increasing effects are not compensated by the decreasing effect resulting from the reduced risk in industry y. Hence, the tariff introduction in industry x boosts $\alpha_{y,t}$.

With the stronger risk in industry x, the worker reduces the shares of industry x in his portfolio. He reduces asset x as the risk effect compensates the increased return. The hedging property of asset y still works but is reduced with the weaker impact of the asset covariance on the asset demand.

Again, a definite statement about a change in the total asset demand is not possible. Referring to the symmetry between the two risky assets in the model does not reject the assumption of a stable total asset demand. Yet, the concentration result of Cassing (1996) cannot be confirmed. In Cassing (1996) the tariff introduction benefits one firm and hurts the other. Countereffects between these firms are neglected. The present paper considers these possible countereffects not between firms but industries. Thus, we enable the investor not only to adjust to the tariff itself but also to variations in the other industry. Hence, in contrast to Cassing (1996), there is a rebalancing of the portfolio towards the unprotected industry. The wealthy worker exploits strongly the diversification possibilities on the asset market.

Scenario Vb: worker in unprotected industry x, diverging shock

variation for both industries

In this variation of the previous scenario, the changed tariff impact on the asset covariance implies one asset demand enhancing effect facing three asset demand decreasing effects. The asset demand reacts more sensitively to the additional risk than to the increased expected excess return in industry x. Consequently, α_x decreases with the tariff introduction in industry x.

Allowing for a high consumption elasticity for wealth and a relatively low one for labour income yields

$$\frac{1}{\gamma} > (1 - \omega). \tag{1.35}$$

The assumption of a high risk share implies a relatively wealthy worker with low dependence on his labour income. This justifies the elasticity relaxation. Based on these considerations, the expected excess return in industry x would gain on weight and dilute the negative tariff impact on the asset demand. However, this effect is still not strong enough to completely compensate the three decreasing risk effects.

In contrast to the demand for asset x, the demand of asset y increases in $\sigma_{y,l}$. Precisely, when the risk of asset y and the labour income are negatively correlated, asset y represents a hedge possibility for the labour risk. Moreover, there is the possibility for a change of the tariff impact on the asset labour covariance because the two sources of risk are differently affected by the tariff. Firstly, the tariff impact on the asset covariance is considered to be negative. It is peculiar that the direct effect of the asset covariance on the asset demand be positive but could easily turn negative. A relatively high consumption elasticity with respect to financial income causes this switch. However, we proceed with the initial

assumption of a moderate consumption elasticity towards labour as well as financial income. Thus, the direct demand reaction towards changes in the asset covariance is positive. As the industry x shows a higher vulnerability to shocks than industry y, the overall effect on the labour asset covariance is negative too. Hence, the total effect on the asset demand is negative.

Comparing the intra-industry effects with each other shows that the total intra-sectoral effect on the demand of asset y is determined by the expected excess return and is therefore negative.

The determination of the inter-industry effect has to follow from the demand reaction on the components. Here the asset covariance over-compensates the labour asset covariance. Consequently, the total inter-industry effect increases the demand for asset y.

Finally, the total effect of the tariff on the demand of asset y is positive. The worker does rebalance his portfolio completely towards asset y. He reduces his portfolio share of industry x and he increases his share of asset y, as it works as a hedging instrument of the strengthened risk in industry x.

In particular, the portfolio will be biased towards asset y. Also, we find an investment concentration in the unprotected industry which is in contrast to the findings of Cassing (1996); consequently a labour risk hedge is given. The worker increases his share of asset y in his portfolio and therefore compensates for the higher risk in industry x. Eventually, the results do not confirm a reduced use of the asset market.

Scenario VIa: worker in industry y, similar shock variation for both

industries

Lastly, we analyse the constellation where labour income is generated in the unprotected industry of the home country. Hence, the labour income and the return of asset x are negatively correlated, whereas the correlation between the labour income and the return of asset y is positive. Furthermore, the asset correlation is still negative. Both covariances are positively affected by the tariff. The tariff impact on the demand for asset x is

$$\frac{\partial \alpha_{x,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{x,t}}{\partial \mu_x}}_{(+)} \underbrace{\frac{\partial \mu_x}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_x^2}}_{(-)} \underbrace{\frac{\partial \sigma_x^2}{\partial \tau_{x,t+1}}}_{(+)} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,y}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{x,t}}{\partial \sigma_{x,l}}}_{(+)} \underbrace{\frac{\partial \sigma_{x,l}}{\partial \tau_{x,t+1}}}_{()}. \qquad (1.36)$$

So the overall effect of the tariff obviously decreases the demand of asset x.

For completeness, the effects on the demand of asset y are analysed. The demand reaction on the labour asset covariance changes and now has a negative sign. The total tariff impact on the demand of asset y is

$$\frac{\partial \alpha_{y,t}}{\partial \tau_{x,t+1}} = \underbrace{\frac{\partial \alpha_{y,t}}{\partial \mu_y}}_{(+)} \underbrace{\frac{\partial \mu_y}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_y^2}}_{(-)} \underbrace{\frac{\partial \sigma_y^2}{\partial \tau_{x,t+1}}}_{(-)} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{x,y}}}_{(-)} \underbrace{\frac{\partial \sigma_{x,y}}{\partial \tau_{x,t+1}}}_{()} + \underbrace{\frac{\partial \alpha_{y,t}}{\partial \sigma_{y,l}}}_{(-)} \underbrace{\frac{\partial \sigma_{y,l}}{\partial \tau_{x,t+1}}}_{(-)}. \qquad (1.37)$$

The tariff effect on the asset covariance increases in the tariff while the labour asset covariance does not change in reaction to the tariff. With the negative asset correlation and the positive labour risk correlation, the labour asset covariance determines the effect on the demand of asset y of the two covariances. Hence, the positive intra-industry effect compensates the negative inter-industry effect. On the other hand, the demand of asset y reacts more sensitively by changes in the expected excess return than to the risk increase. All effects together lead to an undetermined reaction of the asset y demand.

In this case, the worker decreases his share of asset x. A definite statement of his shares of asset y is not possible. Clearly, there is no labour risk hedge anymore.

However, in scenario VIa, with a high total risk share, negative asset correlation and labour income generated in the non-protected industry we find an investment concentration in the neither industry. Furthermore, there is no labour hedge and no definite reduction or increased asset market exploitation.

Scenario VIb: worker in industry y, diverging shock variation for both industries

Now the demand for asset x depends negatively on the asset covariance and also negatively on the asset covariance. The latter impact changes in contrast to the previous scenarios because of the different labour correlations. Therefore, the two risks can be higher than in the case with positive labour correlation and still the demand dependency does not change. Nevertheless, there is a change in the demand dependency on the labour asset covariance. The demand for asset x increases in the labour asset covariance because asset x now serves as a hedging instrument for labour income.

Both covariances decrease in consequence of the tariff introduction in industry x. The increased industry risk exceeds the increased excess return. Hence, two counteracting effects face each other. The total tariff impact on $\alpha_{x,t}$ in the state with high total risk, negative asset correlation and negative labour correlation is not determined.

Further to the previous section, the stronger risk decrease in industry y is analysed and therefore both covariances are negatively affected. Obviously, the tariff in industry x increases the demand of asset y.

The worker does not definitely rebalance his portfolio towards asset y. The industry risk and the labour risk dilute the financial hedging motive and the reallocation of asset x is

not unambiguous. But the worker increases his share of asset y. As a result of the reduced risk, he can reduce his portfolio risk by increasing the number of assets included. Therefore, the total asset demand might increase in the tariff if the demand for asset x remains stable. A definite statement is not possible as the direction of the demand for asset x cannot be fully determined. So, for scenario VIb with high portfolio risk, negative asset correlation, labour income generated in the non-protected industry and a negative tariff impact on the asset covariance, we state a slight investment concentration in the non-protected industry - against the expectations in the literature. But we find no definite decreasing asset market activities. Hence, there might be a possible labour risk hedge. In comparison to the scenario with the labour income generated in the protected industry, we find a weakening of the positive tariff impact on $\alpha_{x,t}$ through the changed labour risk correlation. In contrast, the positive tariff impact on $\alpha_{y,t}$ is strengthened by the changed labour risk correlation.

1.6 Conclusion

The aim of the present chapter is to show the effects of different trade regimes on the investment behaviour of a representative working individual and a possible hedge of labour income risk. Does trade liberalisation increase and trade protection decrease workers' asset market activities?

From the present analysis four main components for possible asset market exploitation and therefore a possible labour income hedge can be found. Firstly, the already existing total risk share in the portfolio has a significant influence on the total asset demand. Secondly, the tariff impact on the asset covariance is decisive for the asset allocation. Further-

more, the correlation between the two risky asset returns affects the labour income hedge under protectionist trade policy. Lastly, it is important whether the risky labour income is generated in the protected industry or in the unprotected industry. All these different factors stand for a different kind of risks and these various risk sources influence the investment decision of the individual in different ways.

The first three risk sources have unambiguous total effects on the investment and asset allocation decision of the worker. They differ in every isolated case. The most important factor in the asset allocation decision is whether the worker works in the protected or unprotected industry. The income source - industry x or y - determines the impact of the trade policy on the individual investment.Especially for the worker with a low total risk share the location of the income source effects the asset allocation decision significantly. Trade policy diminishes the total asset demand for a worker in the protected industry. For workers in the non-protected industry, protectionist trade policy leads to an increasing asset demand. In particular, high shock vulnerability in the protected industry boosts the asset demand. Consequently, trade liberalization increases asset market activity especially in those countries with a representative investor working in the protected industry, and tends to decrease asset market activity in countries with the representative worker in the non-protected industries. These conclusions are only valid for investors with a low total risk share in their portfolio.

For the investor group with a high total risk share in the portfolio, there is no unambiguous statement about the working location effect possible. One explanation is that investors with a high total risk share are usually relatively wealthy. With increasing wealth,

more precisely with a high liquid wealth - labour income ratio, the labour hedge motive becomes less important and the financial hedge motive gains weight. Hence, the source of the working income, industry x or y, has no crucial impact on their investment and asset allocation decision. The results are strengthened with a respective adjustment of the consumption elasticity towards financial income.

In particular, the consequences of trade policy on the individual investment decision and thus considerations on the impact of overall employment cannot be determined in general. The different country conditions and industry relations within this country have to be taken into account. Furthermore, the characteristics of the different investor and employee groups strongly determine the final conclusion. However, it becomes clear that not only financial integration does drive trade integration but trade integration is also an instrument to increase financial integration. Mutual effects between a country's industries are also necessary to be considered for the extent of financial activities. Hence, if a government is interested in an increasing level of asset market activities of a specific investor group trade liberalization might be an additional stimulating instrument. This is especially valid for countries with a high share of poor workers in a large protected industry sector.

1.7 Appendix

	$f > \frac{1}{2}$	$f < \frac{1}{2}$
$0 < \sigma_{x,y} < \left(\frac{1}{\gamma\omega}\mu_x - \frac{1-\omega}{\omega}\sigma_{x,l}\right)\frac{1}{f-\frac{1}{2}\frac{1}{\gamma\omega}}$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_x^2} < 0$	/
$0 < \sigma_{x,y} > \left(\frac{1}{\gamma\omega}\mu_x - \frac{1-\omega}{\omega}\sigma_{x,l}\right)\frac{1}{f-\frac{1}{2}\frac{1}{\gamma\omega}}$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_x^2} > 0$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_x^2} < 0$
$0 > \sigma_{x,y} < \left(\frac{1}{\gamma\omega}\mu_x - \frac{1-\omega}{\omega}\sigma_{x,l}\right)\frac{1}{f-\frac{1}{2}\frac{1}{\gamma\omega}}$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_x^2} > 0$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_x^2} < 0$
$0 > \sigma_{x,y} > \left(\frac{1}{\gamma\omega}\mu_x - \frac{1-\omega}{\omega}\sigma_{x,l}\right)\frac{1}{f-\frac{1}{2}\frac{1}{\gamma\omega}}$	/	$\frac{\partial\alpha_{x,t}}{\partial\sigma_x^2} > 0$

Table 1.1. Impact of Asset Variance i on Demand of Asset i

In Table (1.1) labour income is positively correlated with asset i.

	$f > \frac{1}{2}$	$f < \frac{1}{2}$
$\sigma_{x,y} > 0;\ \sigma_x^2 > \left[\frac{1}{\gamma\omega}\mu_x - \frac{1-\omega}{\omega}\sigma_{x,l}\right]\frac{1}{\left(f-\frac{1}{2}\frac{1}{\gamma\omega}\right)}$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_{x,y}} < 0$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_{x,y}} > 0$
$\sigma_{x,y} > 0;\ \sigma_x^2 < \left[\frac{1}{\gamma\omega}\mu_x - \frac{1-\omega}{\omega}\sigma_{x,l}\right]\frac{1}{\left(f-\frac{1}{2}\frac{1}{\gamma\omega}\right)}$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_{x,y}} > 0$	/
$\sigma_{x,y} < 0;\ \sigma_x^2 > \left[\frac{1}{\gamma\omega}\mu_x - \frac{1-\omega}{\omega}\sigma_{x,l}\right]\frac{1}{\left(f-\frac{1}{2}\frac{1}{\gamma\omega}\right)}$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_{x,y}} > 0$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_{x,y}} < 0$
$\sigma_{x,y} < 0;\ \sigma_x^2 < \left[\frac{1}{\gamma\omega}\mu_x - \frac{1-\omega}{\omega}\sigma_{x,l}\right]\frac{1}{\left(f-\frac{1}{2}\frac{1}{\gamma\omega}\right)}$	$\frac{\partial\alpha_{x,t}}{\partial\sigma_{x,y}} < 0$	/

Table 1.2. Impact of Asset Covariance on Demand of Asset i

In Table (1.2) labour income is positively correlated with asset i.

	$\sigma_{x,y} > 0$	$\sigma_{x,y} < 0$
$f < \frac{1}{\gamma\omega}\left(\frac{\mu_y}{\sigma_y^2} + \frac{1}{2}\right) - \frac{1-\omega}{\omega}\frac{\sigma_{y,l}}{\sigma_y^2}$	$\frac{\partial\alpha_{y,t}}{\partial\sigma_{x,y}} > 0$	$\frac{\partial\alpha_{y,t}}{\partial\sigma_{x,y}} < 0$
$f > \frac{1}{\gamma\omega}\left(\frac{\mu_y}{\sigma_y^2} + \frac{1}{2}\right) - \frac{1-\omega}{\omega}\frac{\sigma_{y,l}}{\sigma_y^2}$	$\frac{\partial\alpha_{y,t}}{\partial\sigma_{x,y}} < 0$	$\frac{\partial\alpha_{y,t}}{\partial\sigma_{x,y}} > 0$

Table 1.3. Impact of Asset Covariance on Demand for Asset j

In Table (1.3) labour income is positively correlated with asset j.

$\frac{\partial \sigma_{x,y}}{\partial \tau} > 0$	$q_y > 0,5$	$q_x > 0,5$	$q_y > q_x$
$\frac{\partial \sigma_{x,y}}{\partial \tau} > 0$	$q_y < 0,5$	$q_x < 0,5$	$q_y < q_x$
$\frac{\partial \sigma_{x,y}}{\partial \tau} > 0$	$q_y > 0,5$	$q_x < 0,5$	$q_y > (1 - q_x)$
$\frac{\partial \sigma_{x,y}}{\partial \tau} > 0$	$q_y < 0,5$	$q_x > 0,5$	$q_y < (1 - q_x)$

Table 1.4. Impact of Tariff on Asset Covariance

In Table (1.4) industries x and y are positively correlated.

$\frac{\partial \sigma_{x,y}}{\partial \tau} < 0$	$q_y > 0,5$	$q_x > 0,5$	$q_y < q_x$
$\frac{\partial \sigma_{x,y}}{\partial \tau} < 0$	$q_y < 0,5$	$q_x < 0,5$	$q_y > q_x$
$\frac{\partial \sigma_{x,y}}{\partial \tau} < 0$	$q_y > 0,5$	$q_x < 0,5$	$q_y < (1 - q_x)$
$\frac{\partial \sigma_{x,y}}{\partial \tau} < 0$	$q_y < 0,5$	$q_x > 0,5$	$q_y > (1 - q_x)$

Table 1.5. Impact of Tariff on Asset Covariance

In Table (1.5) industries x and y are positively correlated.

Chapter 2
FDI and FPI - Strategic Complements?

2.1 Introduction

The recent World Investment Report 2006 highlights that Foreign Direct Investment (FDI) flows and growing FDI stocks are now at an unparalleled level with the highest share going to industrial countries. At the same time, flows of international portfolio investments (FPI) exceeded FDI flows twice at the beginning of the nineties, whilst more recently FPI growth slowed down and both capital flows converged (WTO 1996). What are the motives for firms to invest in one or the other and how are they to be explained?

Previous studies on FDI explained the motives for FDI with differential rates of return, differences in interest rates and risk diversification (Dunning (1973)). Following Andersen and Hainaut (1998), these determinants lost explanatory power and recent theoretical and empirical studies document that FDI is undertaken to exploit cost advantages (vertical FDI) or to serve different markets locally to avoid trade costs (horizontal FDI).[30], [31] If FDI no longer serves risk diversification does FPI fill the gap and are these capital flows strategic complements rather than substitutes?[32]

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[30]   Grossman, Helpman, Szeidl (2005) discuss in which states firms decide to outsource or offshore some of their production stages. Acemoglu, Aghion, Griffith and Zilibotti show that vertical integration is more common if the technology intensity differs significantly.

[31]   See Helpman, Melitz, Yeaple (2003) for a detailed survey on whether firms decide to serve a foreign market through export or FDI - horizontal FDI. Studies of complex FDI strategies can be found for example in Helpman (2006) or Grossman, Helpmann, Szeidl (2003).

[32]   In contrast to the consumer theory, the cross-price elasticity of demand is not the decisive factor for the present distinction between complements and substitutes. In the present analysis, "strategic-complements"

We analyse whether firms choose FDI or FPI in the presence of stochastic productivity taking into account differences in flexibility of both investments. As FDI requires higher investment specific costs, it is not possible to adjust FDI to environmental changes every period.[33] In contrast, FPI bears lower fixed costs and can be adjusted immediately to short-term changes in the environment. In particular the assumption is that FDI is less flexible than FPI and this reduced flexibility entails a higher rigidity of FDI. A further distinction between FDI and FPI is the possibility to exert control. FDI encloses control rights for the investor. Thus, the investor is manager and owner in one person. He has facilitated access to all information and has the opportunity to navigate the investment according to his own interests. FPI, on the other hand, does not comprise control rights. In this case, the investor and the manager are different persons with differing interests. Information asymmetries and agency problems can arise. Consequently, the investment project is not necessarily completely managed in line with investors' interest. Following Goldstein and Razin (2004), as a result of the investors' control position FDI yields a higher return than FPI. Hence, there is a trade-off between flexibility and higher return for firms deciding between FDI and FPI. We explore whether as a consequence of higher investment specific fixed costs and lower flexibility in the case of FDI, small firms prefer FPI and larger firms invest in FDI.

We show that the combined investment strategy (FDI and FPI at the same time) always starts the international investment activity earlier in time than the isolated strategy

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represents the conscious choice of the investor to combine both investment instruments. The decision whether to combine both investments depends not only on the price / costs of the investment but on the risk correlation and flexibility of the respective investment instrument.

[33]   See Goldstein and Razin (2005) for a discussion on the different costs for FDI and FPI.

(FDI or FPI). Additionally, with combined international investment, there is a higher incentive for firms to invest in research and development (R&D) and consequently firm productivity increases faster than with isolated international investment. Depending on the success-probability and the correlation between the various investment possibilities, even small firms (low productivity) invest in FDI.

To model firm behaviour, we use a monopolistic competition framework with uncertain firm productivity in combination with a dynamic investment approach over a finite investment horizon. There are three countries, home and two foreign countries. The firms are located in the home country and decide to invest via FDI or FPI in the foreign countries. Therefore, they face uncertainty about their future productivity and returns on the respective investment. In particular, firm productivity is endogenous and follows a Poisson process. The productivity of the different investment opportunities are correlated with each other. Differences in correlation between FDI and home production account for different forms of FDI.[34]

The remainder of Chapter 2 is organized as follows. In section 2, we examine the different definitions of FDI and FPI and explain the motivations for firms to invest in FDI or FPI on the existing literature. Section 3 outlines the theoretical framework and derives the optimality conditions for the various investments strategies. Following this, we present the numerical solution of the model and discuss the results in section 4. Finally, section 5 concludes Chapter 2.

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[34]   Aizenman and Marion (2004) as well as Markusen and Maskus (2001) show that horizontal FDI is established in countries similar in size and endowments, whilst vertical FDI is the preferred investment in countries with different characteristics as the source country.

2.2   Why should firms diversify their risk and combine FDI and FPI?

The first problem that arises is to distinguish between the two investment instruments FDI and FPI. FDI and FPI consist of different kinds of foreign equity interests like equity shares, securities or derivatives.[35] Most of all, the explanation of FDI and the accompanying activities are not unambiguous. There is the macro view which counts FDI as a specific capital flow between various countries. It measures FDI in Balance of Payments Statistics. On the other hand, the micro view examines the motivations of foreign direct investment from the investors' point of view. This view concentrates especially on the consequences resulting from investment for the investor, the host and the home country as well as on the firm activities. The main emphasis is that the motivation as well as the consequences of FDI arise from the investors' - the investing firms' - control and influence on the management of the foreign investment or affiliate. However, the definition of FDI does not only change with the underlying theory but also has changed in time and still changes with the defining institution. A prominent and widely accepted definition is the IMF (1993) concept. It is stated relatively vaguely that a direct investment is international investment that comprises a long-term interest in the relationship between the investing and the foreign firm. Furthermore, the investing firm clearly possesses a significant influence on the management or production process of the foreign firm. In addition to this rather loose concept, the IMF exemplifies a specific recommendation of 10% share-ownership at which FDI and a

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[35]   FPI, in a broader sense, can also include bonds, money market instruments, financial options and debt securities.

corresponding degree of control are identified. The IMF FDI perception complies with the Balance of Payment Statistics view of FDI.

The micro view is more represented by the FDI definition of the United Nations System of National Accounts. In this concept, the main emphasis is placed on the investors' control over the foreign firm. The threshold for control and a perceptible influence on the foreign firm is at 10 - 50% or more of shares owned by the investing firm. The precise share depends on the individual country definition of foreign control.[36] These are only two examples for the differing concepts and definitions of FDI. Based on these diverging perceptions, it is difficult to distinguish explicitly between FDI and FPI. Moreover, the ambiguous definitions do not really provide a clear cut between FDI and FPI: Lipsey (1988) quotes an example where previous portfolios flows were converted into direct investment flows. Hence, there is no unambiguous distinction of FDI and FPI from the composition of the respective capital flow or by a definite control threshold. Consequently, in the present chapter we will emphasize the various characteristics such as control and volatility of the two investment instruments to distinguish between them. Furthermore, we will examine what the motivations of a firm are to invest in FDI or FPI and whether there are any gains from combining both investments.

The second question concerns mainly the motivations for a firm to invest in FPI. Whilst firms' motivations to invest in FDI are widely explored, the reasons for FPI are rather unexplored or just ignored. An arising strand of literature highlights the increasing interest and necessity in firms' risk hedging. This constitutes a more than appropriate mo-

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[36]   For a detailed discussion of this concept see Inter-Secretariat Working Group on National Accounts (1993). For more various views on FDI and its definition, see Lipsey (1999, 2001).

tivation for firms engaging in FPI. An accepted reason for multinational firms to engage in risk sharing via financial markets is exchange rate volatility. Mello et al. (1995) for example show that the production choice and the competitive position of a firm depend strongly on an appropriate financial risk hedging strategy with respect to exchange rate risk. One of the first approaches to combine financial hedging and corporate diversification is made by Ding and Kouvelis (2007). Still, they justify a firms' hedging necessity solely on exchange rate risk and price uncertainties. Lim and Wang (2007) show that operational risks arising inside the firm, for example the uncertainty of firm-specific investments by non-financial stakeholders, may also require firms to engage in risk diversification. Furthermore, they argue that it is not only possible to combine financial and corporate diversification to hedge external and internal risks more efficiently, they actually find that the combination of the two hedging instruments complement each other. Lim and Wang argue that financial and corporate diversification hedges different types of risk. Movements of the market or industry as a whole can be hedged with financial instruments but not with corporate diversification. On the other hand, it is impossible or extremely costly to reduce firm-specific risk via financial markets. Corporate diversification is the appropriate instrument to hedge this idiosyncratic risk. If a firm engages in financial risk sharing and thus reduces its systematic risk, then the share of idiosyncratic risk increases. Consequently, reducing firm-specific risk by corporate diversification becomes more valuable. These considerations confirm our assumption that a combination of FPI and FDI may enhance the value of international direct investment for a firm.

A third controversial factor is the question of why a firm should engage in financial hedging. The common view is that a firm should emphasize its operational activities and risk diversification should be managed by the respective shareholder himself. However, the empirical evidence shows that firms indeed engage in risk diversification.[37] There are several reasons why risk diversification by a firm cannot be substituted by shareholder portfolio diversification. First of all, financing costs can be reduced and tax benefits can be realized if financial risk diversification is undertaken by the firm instead of each individual shareholder.[38] A further advantage of firms' risk hedging activities is the reduction of risk for not fully diversified managers and investors. Nevertheless, a crucial point is the protection of firm-specific investment of non-financial stakeholders. These investments are a function of a firms' total risk and hence financial risk diversification enhances firm-specific investments. Again, this supports our assumption of additional gains for firm by combining FDI and FPI.

Additionally, we link the information based trade-off literature between FDI and FPI by Goldstein and Razin (2005) (GR) and Albuquerque (2003) with the firm-level Export and FDI approaches by Grossman, Helpman and Szeidl (2006), and Helpman, Melitz and Yeaple (2003). GR analyse the investors' decision between FDI and FPI under asymmetric information in a static model.[39] As a result of the information asymmetry the project revenue from FDI is higher than from FPI. In the case of FDI the investor is also the manager

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[37]   See for example Bodnar et al. (1998). For more recent empirical evidence see Gates (2006) and Nocco and Stulz (2006).

[38]   Stulz (1984) offers an extensive survey on the reasons for corporate risk management. Froot et al. (1993) emphasize on the reduced financing costs, and Graham and Smith (1999) examine the tax benefits of firms risk hedging activities.

[39]   See also Razin, Mody and Sadka (2002) and Razin (2002).

of the foreign firm. Hence, he has a higher control over the production processes and can ensure that the firm is run accordingly to the investors' interests. If the investor chooses FPI, the investor has no control over the foreign production process and the expected return is lower. In the present chapter we use these different characteristics shown by GR to motivate the costs, flexibility and return of the different investment possibilities. Additionally, we consider the findings of Chuhan, Perez-Quiraz and Popper (1996). They provide an empirical analysis on the different characteristics of short term and long term capital flows.[40] Furthermore, in contrast to GR, we introduce a long-term investor in a dynamic setting. This investor has the opportunity to adjust his portfolio periodically with rigidity in FDI-shares. Hence, we also account for the different grades of flexibility of both investments.

Albuquerque (2003) analyses from a country perspective the risk-sharing character of FDI and non-FDI capital flows for countries with different degrees of financial constraints. Therefore, non-FDI flow adjustments arise from shocks in the receiving country. One result is that for financially constrained countries, FDI is less volatile than non-FDI flows. With perfect enforcement, the difference in volatility diminishes. We modify this approach by taking the firm perspective and consider shocks on firm level as well as on host country level. As a matter of fact, we always find a higher volatility of non-FDI flows (FPI) than FDI flows in our firm-level perspective. The firm reacts to any short-term environment change by adjusting FPI. Precisely, FPI has the main function to smooth risk whereas FDI mainly exploits gains from technology transfers.

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[40]   Lipsey (2001) also emphasizes differences in volatility as a distinction between FDI and FPI.

Uncertain firm productivity is decisive for the results of our model. This leads to the literature by Melitz (2003) or Grossman, Helpman and Szeidl (2006). They motivate the firms' choice to export or engage in FDI with differing firm productivity. Melitz (2003) shows that with heterogeneous productivity only the largest firms (with high productivity) export. Small firms serve the domestic market only. Furthermore, Helpman, Melitz and Yeaple (2003) expand on this and find that firms with higher productivity use higher integrated organisational production structures. They show that less productive firms only serve the domestic market. If firms increase their productivity, they start to export and finally the most productive firms engage in FDI. In all these models firms can only invest in FDI and have no other investment opportunity. We extend these models by introducing FPI as a new form of investment possibility. In contrast to the existing literature, we allow firms to choose to invest in FDI or FPI or to combine both. The results show that a possible combination of both investments leads to more flexibility of the firm. This means a firm can use FPI to dampen short term environment changes to which it is not possible to react with FDI. Consequently, firms invest in FDI at a lower productivity than in the existing models. Furthermore, in the present chapter firm productivity is endogenous. Firms can push their productivity by investing in research and development (R&D). The success of the R&D-investment is uncertain.

2.3   Theoretical Framework

The dynamic methodology in the model follows roughly the models of Abel (1973) and Holt (2003).

Firms optimize their investment decisions in a continuous-time model.[41] Inspired by Melitz (2003), the model is based on monopolistic competition with stochastic firm productivity. Domestic demand is exogenous and the consumers have Dixit-Stiglitz preferences. There are three countries. Two of these countries are northern countries West (home country) and East (foreign). The third country is a southern country (foreign). In the eastern country, as a result of the factor endowments, production and cost structure are similar to the home country. Additionally, these countries are also based on a close cultural background. Hence, we assume a positive correlation of the productivities between the East and the home country. On the opposite, the South has different production structure, cost structure and cultural background than the home and the eastern country. We assume negative productivity correlations between South and home or South and East.

We consider a setting in which a representative firm faces a choice between performing activities at home (production and R&D-investment) and engaging in two alternative foreign investments: foreign portfolio investment (FPI) or foreign direct investment (FDI). The initial position of each firm is home production and home R&D investment. Based on these home activities, the firm can additionally choose to invest internationally. The firm's specific productivity θ is the crucial factor for the international investment decision of the firm. In particular, the firm can increase its specific productivity by investing in domestic

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[41]   Time runs from 0 to T.

research and development (R&D). Whether R&D-investment increases the firm's productivity is uncertain. The change of θ through R&D-investment follows a Poisson-Process

$$d\theta = \left[(1-\tau)\frac{\phi_t}{K_t}\right]\theta_t dq. \tag{2.38}$$

In (2.38) ϕ_t is the capital invested in R&D and K_t is the total stock of capital available to the firm in period t.[42] As obsolete technologies have to be replaced, patent laws are renewed and so forth, even in the case of successful R&D-investment, the growing rate of θ is smaller than the invested rate of capital. These costs correspond to a constant depreciation and are depicted by $\tau \in [0,1]$. Finally q is a random variable that equals 1 with probability λ and 0 otherwise. Hence, if R&D-investment is successful, θ increases by $\left[(1-\tau)\frac{\phi}{K}\right]\theta$. With probability $(1-\lambda)$ R&D-investment fails and θ stays unchanged.

As every firm, no matter whether it engages in FDI, FPI or not, produces at home and serves the home market, we start with the analysis of the home country.

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[42] $t \in [0,T]$.

2.3.1   Home

Production

The firm uses a single factor, capital, to produce output at home x^h

$$x_t^h (\theta_t) = \theta_t \left(k_t^h \right)^\alpha . \tag{2.39}$$

The superscript h states that these are the values in the isolated "Home"-scenario.[43] Accord-

ing to (2.38), firms can also use capital to invest in R&D and increase their productivity

$$K_t = k_t^h + \phi_t. \tag{2.40}$$

As a consequence of monopolistic competition, firms choose the profit maximising-price[44]

$$p_t = \frac{1}{\varphi \theta_t}. \tag{2.41}$$

Where the rent for capital is set equal to one, $\frac{1}{\varphi}$ is the profit maximizing mark up and $\frac{1}{\theta_t}$ are

the marginal costs of a firm with productivity θ_t. Furthermore, the firm has fixed costs of

home production equal to f_t^h and costs of R&D-investment equal to ϕ_t. Hence, the profit

of the firm at home in period t is

$$\pi_t (\theta_t) = p_t \theta_t \left(k_t^h \right)^\alpha - \left(f_t^h + \frac{x_t^h}{\theta_t} + \phi_t \right), \quad 0 < \alpha < 1. \tag{2.42}$$

The first term on the right hand side equals the revenue from production and sales at the

home market, r_t^h. The second term on the right hand side summarizes the costs of home

production and R&D investment.

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[43]   The following scenarios with isolated FPI, FDI and the combined investments are identified by the super-
scripts p, d, and c respectively.

[44]   See 2.6 Appendix for the demand function and the derivation of the profit function.

The expected value of firm profits over the whole time horizon is

$$V^h(\theta_t) = \max_{k_s^h, \phi_s} E_t \int_t^T \pi_s(\theta_s) e^{-\rho(s-t)} ds. \tag{2.43}$$

subject to (2.39) - (2.41). Modification of (2.43) yields:

$$\rho V^h(\theta_t) dt = \max_{k_t^h, \phi_t} \pi_t(\theta_t) dt + E_t(dV^h) \tag{2.44}$$

which states that the mean required return of a firm equals the expected return. In period t, the expected return consists of the maximized profit at t and the expected gain or loss of the future profit flow.

To calculate the expected capital flow, we substitute (2.38) into dV^h:

$$E_t(dV^h) = \lambda \left[V^h(\gamma_t \theta_t) - V^h(\theta_t)\right] dt \tag{2.45}$$

with $\gamma_t \equiv (1-\tau) \frac{\phi_t}{K_t}$.[45] Equation (2.45) is the expected capital flow. The expected capital flow is a perpetual flow of the difference between the capital flow in case of successful R&D investment $V^h(\gamma_t \theta_t)$ and without successful R&D investment $V^h(\theta_t)$ weighted with the success-probability. Substituting (2.45) back into (2.44) and divide by dt yields:

$$\rho V^h(\theta_t) = \max_{k_t^h, \phi_t} \left\{\pi_t(\theta_t) + \lambda \left[V^h(\gamma_t \theta_t) - V^h(\theta_t)\right]\right\}. \tag{2.46}$$

There are two important features about (2.46) which one should keep in mind thourought the following analysis: firstly, all important information about the past concerning current or future decisions is summarized in θ. How the firm reached the present productivity does not matter at all. Secondly, choosing the optimal production and R&D-investment strategy with respect to the problem starting at the current productivity level θ that results from the

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[45]   For a detailed derivation see 2.6 Appendix.

initial firm strategies, is the optimal strategy no matter what the initial strategy of the firm was.

Optimality Conditions for R&D-Investment and Production Strategies

From (2.46) we can derive the optimality conditions for firm-strategies for R&D-investment and home production.

R&D Investment Deriving the first order condition for R&D-investment from (2.46) yields[46]

$$\pi_\phi\left(\theta\right) + \lambda V_\phi^h\left(\gamma\theta\right) = 0. \tag{2.47}$$

The second part of the brackets of (2.46) disappears, as $V^h\left(\theta\right)$ does not depend on the current ϕ. Rearranging (2.47) delivers:[47]

$$V_\phi^h\left(\gamma\theta\right) = \frac{1}{\lambda}\left[1 - \frac{r_\phi^h\left(\theta\right)}{\omega}\right]. \tag{2.48}$$

The marginal valuation of R&D-investment is a perpetual flow equal to one minus the revenue changes caused by ϕ, discounted by the probability of successful R&D-investment. The return decreases in the additional R&D investment because available capital for the domestic production is reduced. Thus (2.48) is positive. However, R&D investment increases the productivity and so does the output produced with one unit capital. Consequently, the valuation of additional R&D corresponds to the decreased return caused by the R&D investment.

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[46]   For simplification, the time indices are dropped.

[47]   For mathematical details see 2.6 Appendix.

Home Production Differentiating the right hand side of (2.46) with respect to k^h, we obtain the optimality condition

$$
\begin{aligned}
\pi_{k^h}(\theta) + \lambda \left[V_{k^h}^h(\gamma\theta) - V_{k^h}^h(\theta) \right] &= 0 \\
\frac{r_{k^h}(\theta)}{\omega} + \lambda \left[V_{k^h}^h(\gamma\theta) - V_{k^h}^h(\theta) \right] &= 0 \\
V_h^h(\gamma\theta) &= V_h^h(\theta) - \frac{1}{\lambda} \left[\frac{r_h^h(\theta)}{\omega} \right].
\end{aligned}
\tag{2.49}
$$

The subscripts unequal to t stand for the partial derivation. For simplicity, in the following cases the derivation subscripts are shortened to h for the derivation with respect to capital invested in home production instead of k^h.[48] The marginal valuation of production-investment, in the case of successful R&D-investment equals the marginal valuation of production-investment with no R&D investment minus the marginal revenue stream resulting from increased capital in production - discounted with the probability of successful R&D-investment. It is $V_h^h(\theta)$ minus the revenue stream, as the valuation of k^h in case of additional investment in R&D is examined. Capital is divided between R&D investment and domestic production. If R&D investment is successful, the valuation of domestic production decreases relatively to unsuccessful R&D because there is an alternative use for capital with a high valuation. Analysing just the valuation of k^h without the increased productivity would be $V_h^h(\gamma\theta)$ plus the revenue stream.

An optimal strategy requires that the marginal valuation of investment in production equals the marginal valuation of R&D-investment. We can derive an explicit marginal

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[48] The subscripts will be analogue p for investment in FPI and d for investment in FDI, instead of k^p and k^d.

valuation for investment in production by equating (2.49) and (2.48), namely

$$V_h^h(\theta) = \frac{1}{\lambda}\left[1 + \frac{r_h^h - r_\phi^h}{\omega}\right].$$ (2.50)

Similar to (2.48), the marginal valuation of investment in production equals a flow consisting of one plus the difference between the revenue change caused by the two investment decisions. Again, this flow is discounted by the probability of successful R&D investment.[49]

Equation (2.50) reflects the trade-off between investing in R&D or not. First of all, investing in R&D reduces the capital available to invest in domestic production. This effect is negative. But secondly, R&D-investment increases productivity and higher productivity enforces the output of the employed production-capital and decreases the variable production costs $\frac{x}{\theta}$. Hence, there is also a positive effect of R&D-investment on the marginal valuation of capital invested in home-production. These considerations are reflected in the second part of (2.50).

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[49]   Consequently, $V(\gamma\theta) = -\frac{1}{\lambda}\frac{r_\phi}{\omega}$. The intuition is that with increased ϕ the return decreases directly, $r_\phi < 0$. The valuation of domestic production in total is positive as with foregone R&D investment k_h increases, thus increasing the additional return.

2.3.2 Home and Foreign Portfolio Investment

Now, we analyse the investment decision of the firm and allow for an additional investment alternative, namely foreign portfolio investment (FPI). With FPI equation (2.40) changes to

$$K_t = k_t^h + k_t^p + \phi_t. \tag{2.51}$$

This shows that the total capital available to a firm can be used to invest in domestic production, R&D-investment (the same as in the scenario above) and additionally k^p is the capital invested in FPI. As the firm invests in FPI, it gains ownership of a foreign firm. But the domestic firm has no - or only an infinitely small - possibility to exert control over the foreign production and management process. Thus, the domestic firm cannot directly influence the foreign revenue and the gained dividend

$$r_t^p = \mu_t \left(k_t^p \right). \tag{2.52}$$

μ_t is the return rate from FPI (or the productivity of capital invested in FPI).[50] It varies with

$$\frac{d\mu}{\mu} = \sigma_\mu dz_\mu \tag{2.53}$$

where dz is a Wiener process with mean zero and unit variance.[51], [52] Following (2.52) and (2.53), the only impact the home firm has on the foreign investment is the decision of how much capital to invest in FPI.

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[50] $\mu \in R^+$.

[51] The assumption of the mean zero and unit variance ensures that the increments of the Wiener process are independent distributed random variables. They follow a normal distribution $(z_t - z_s)\,\tilde{}\,N(0, \sigma_z)$ with $0 \leq$ s $<$ t.

[52] Note that μ is defined as the FPI productivity and not the mean of the Wiener process.

Investment in FPI requires buying assets, time to select the appropriate assets, additional administration systems and efforts etc. All these efforts are summarized as fixed costs f_t^p for this investment. Yet, the profit function for the firm (2.42) changes to

$$\pi_t\left(\theta_t\right) = p_t\theta_t\left(k_t^h\right)^\alpha - \left\{f_t^h + \frac{x_t^h}{\theta_t} + \phi_t\right\} + r_t^p - f_t^p. \tag{2.54}$$

Following the steps in the home-scenario, we get the multi-period optimization problem for the firm

$$\rho V^p\left(\theta_t\right) dt = \max_{k_t^h, k_t^p, \phi_t} \pi_t\left(\theta_t\right) dt + E_t\left(dV^p\right) \tag{2.55}$$

subject to (2.39), (2.41) and (2.51) - (2.53). As the firm is now in the FPI-scenario, the superscript changed to p and there is one more control variable, namely k_t^p. The expected future capital flow depends on two state variables θ_t and μ_t:[53]

$$dV^p = V_\theta^p d\theta + V_\mu^p d\mu + \frac{1}{2}V_{\mu\mu}^p\left(d\mu\right)^2 + V_{\mu\theta}^p\left(d\mu\right)\left(d\theta\right). \tag{2.56}$$

Thus, in the case of FPI investment, the expectation of the change in the expected capital flow consists of three parts

$$E\left(dV^p\right) = \lambda\left[V^p\left(\gamma\theta\right) - V^p\left(\theta\right)\right] dt + \left[\frac{1}{2}\mu^2\sigma_\mu^2 V_{\mu\mu}^p\right] dt + \left[V_{\mu\theta}^p\left(\gamma\theta\right)\left(\sigma_\mu\mu\right)\eta^p\right] dt. \tag{2.57}$$

The first part is similar to the expected capital flow in the Home-scenario. Additionally, the variations of the foreign return impact V^p. This impact occurs in the second term. Finally, the third term accounts for common variations of home productivity and foreign productivity that can result from global or industry shocks. The direction of this correlation depends on $\eta^p \equiv \left(dq\right)\left(dz_\mu\right) \neq 0$. If the firm invests FPI in the East, η^p is positive. η^p is negative with FPI in the southern country.

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[53]   For simplification, the time indices are dropped.

In case of FPI, the present value of the firm profit flows is

$$\rho V^p (\theta) = \max_{k_s^h, k_t^P, \phi_s} \left[\pi^p (\theta) + \lambda \left[V^p (\gamma\theta) - V^p (\theta) \right] + \varepsilon \right] \qquad (2.58)$$

with $\varepsilon \equiv \varepsilon^a + \varepsilon^b$, $\varepsilon^a \equiv \frac{1}{2}\mu^2\sigma_\mu^2 V_{\mu\mu}^p$ and $\varepsilon^b \equiv V_{\mu\theta}^p (\gamma\theta) (\sigma_\mu\mu) \eta^p$. The uncertain foreign productivity influences the present value of the profit flows twice. Firstly, the isolated variation of the foreign productivity ε^a enters the capital flows and, secondly, the common variation of home and foreign productivity ε^b changes the capital flows. The home productivity change is a discrete shock and ε is continuous. Similar to (2.46), all necessary information for any decision is summarised in θ and μ. Furthermore, any optimality of future decision on FPI, home production or R&D-investment is independent of the firms' initial decision.

Optimality Conditions with FPI

R&D Investment With FPI the marginal valuation of R&D-investment changes to

$$V_\phi^p (\gamma\theta) = \frac{1}{\lambda} \left[1 - \frac{r_\phi^h}{\omega} - \Phi \right] \qquad (2.59)$$

where $\Phi = \frac{\partial \left(V_{\mu\mu}^p \frac{1}{2}\mu^2\sigma_\mu^2 \right)}{\partial\phi} + \frac{\partial \left(V_{\mu\theta}^p (\gamma\theta)(\sigma_\mu\mu)\eta^p \right)}{\partial\phi}$. FPI does not have any direct impact on the R&D-investment. In comparison to the pure Home-scenario, the marginal valuation of R&D-investment is reduced by Φ. This effect arises through the common variation of the home and foreign productivities. If the firm invests into closely related industries or even in the same industry (eastern country, $\eta^p > 0$) then the own risk is not reduced. Thus Φ is positive and reduces the marginal valuation of R&D-investment slightly but it never completely compensates it. On the contrary, with investment in a dissimilar industry

(South, $\eta^p < 0$) the risk of R&D failure is diversified. Φ is negative and increases the valuation of R&D-investment.

Home Production   The direct valuation of home production is unchanged

$$V_h^p(\gamma\theta) = V_h^h(\theta) - \left[\frac{1}{\lambda}\frac{r_h^h(\theta)}{\omega}\right]. \tag{2.60}$$

Following the optimality principle, we can equate the marginal valuation of investment in home production with the marginal valuation of R&D-investment and get

$$V_h^p(\theta) = \frac{1}{\lambda}\left[1 + \frac{r_h^h - r_\phi^h}{\omega} - \Phi\right]. \tag{2.61}$$

Similar to (2.59), the valuation changes by Φ. Analogue to (2.59), the change depends on the industry invested in.

FPI   Optimality requires that the marginal valuation of FPI also equals the marginal valuation of investment in home production and R&D-investment. Therefore we differentiate (2.58) with respect to k^p and rearranging delivers

$$V_p^p(\gamma\theta) = V_p^p(\theta) - \frac{1}{\lambda}\left[r_p^p + \varepsilon_p\right]. \tag{2.62}$$

Valuation of FPI is lower with investment located in the East (similar production and cost structure, $\varepsilon_p > 0$) than with investment located in the South (different factor endowment, production and cost structure $\varepsilon_p < 0$). Obviously, the diversification of the risk increases the valuation of the investment abroad.

FPI vs Home

The results from deriving all optimality conditions for FDI are summarized in Table (2.6):

R&D	$V_\phi^p (\gamma\theta) = \frac{1}{\lambda} \left[1 - \frac{r_\phi^h}{\omega} - \Phi \right]$	
Home	$V_h^p (\gamma\theta) = \frac{1}{\lambda} \left[1 + \frac{\omega r_p^p - r_h^h - r_\phi^h}{\omega} - \Phi + \varepsilon_p \right]$	.
FPI	$V_p^p (\gamma\theta) = \frac{1}{\lambda} \left[1 + \frac{r_h^h - \omega r_p^p - r_\phi^h}{\omega} - \Phi - \varepsilon_p \right]$	

Table 2.6. Optimality Conditions with FPI

Table (2.6) shows that the effect of FPI on the marginal valuation of investment in home production and R&D is twofold. Additional capital invested abroad reduces capital available for domestic production and R&D-investments. A further effect arises through the exploitation of risk diversification possibilities, Φ. Investment into countries with closely related industries (East) diminishes the valuation of domestic production, $\Phi > 0$. Similar sources of risks are added. Investments in dissimilar countries (South) push the valuation slightly up, $\Phi < 0$. In this case, FPI constitutes a hedging instrument for the existing R&D-risk.

Finally, the additional variation of a further unit capital invested in FPI, ε_p, impacts the valuation of home production. At the same time, ε_p affects the valuation of FPI in the opposite direction. The marginal valuation of home production increases with further FPI in the East, $\varepsilon_p > 0$ and decreases with additional southern FPI. Eastern FPI delivers additional variation and risk. Home production is valued higher as it is a more secure source of future capital flows.[54] FPI in the South hedges existing home risk and consequently the

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[54] FPI valuation decreases through the same effect.

valuation of home production decreases, $\varepsilon_p < 0$.[55] Additional southern FPI dampens the R&D risk and enforces further R&D investments. The firm withdraws capital from home production and invests the available capacities into southern FPI.

Hence, with isolated investment possibilities the firm will engage in southern FPI.

2.3.3 Home and Foreign Direct Investment

In the case of FDI, the home firm takes ownership as well as control over the foreign firm thus being able to influence the profit of its direct-investment. In the present chapter, the firm only transfers capital to the foreign firm. No intermediate goods are traded. However, the choice of the FDI receiving country has a significant impact on the valuation of FDI.

If the home firm decides in favour of FDI, it also transfers intangible assets, as for example managerial skills and technology to the foreign firm. As a side effect of this asset transfer, a part of the home productivity directly enters the return of FDI

$$r_t^d = \psi_t^2 \theta_t^{\frac{1}{a}} \left(k_t^d \right); \qquad 0 < a < 1. \tag{2.63}$$

Home productivity θ does not impact the foreign investment to the same extent as home production. This can be caused by country specific conditions or incomplete mobility of some home skills.[56] ψ is the foreign productivity which is stochastic and varies with[57]

$$d\psi = \psi \sigma_\psi dz_\psi. \tag{2.64}$$

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[55] In this case, the valuation of FPI increases.

[56] With $a \to \infty$, the FDI scenario would be the same as the FPI scenario.

[57] $\psi \in R^+$

Again, dz_ψ is a Wiener process with mean zero and unit variance. The amount of capital invested in FDI is k^d. Hence equation (2.40) becomes

$$K_t = k_t^h + k_t^d + \phi_t. \tag{2.65}$$

Furthermore, FDI requires some specific up-front costs such as country and market research, a merger or building a new plant. All these activities are costly and summarized in f^d, as the fixed costs arising from FDI. Now the modified profit function of the home firm is

$$\pi_t(\theta_t) = p_t \theta_t \left(k_t^h\right)^\alpha - \left\{ f_t^h + \frac{x_t^h}{\theta_t} + \phi_t \right\} + \frac{r_t^d}{\omega} - f_t^d. \tag{2.66}$$

It is important to keep in mind that the FDI fix costs, f^d, exceed the FPI fix costs, f^p.

The dynamic optimization problem of the home firm is

$$\rho V^d(\theta)\, dt = \max_{k_t^h, k_t^d, \phi_t} \left[\pi_t^d(\theta_t)\, dt + E_t\left(dV^d\right) \right]. \tag{2.67}$$

Equation (2.67) is a function of the state variables home productivity θ as well as foreign productivity ψ. The control variables are the three investment purposes, k^h, k^d, ϕ. The derivation of the functional equation from (2.67) is analogue to the steps in the FPI-scenario. Thus, we get

$$\rho V^d(\theta) = \max_{k_t^h, k_t^d, \phi_t} \left[\pi_t^d + \lambda \left[V^d(\gamma_t \theta_t) - V^d(\theta_t) \right] + \kappa \right] \tag{2.68}$$

with $\kappa \equiv \kappa^a + \kappa^b$, $\kappa^a \equiv \frac{1}{2}\sigma_\psi^2 \psi^2 V_{\psi\psi}^d$, $\kappa^b \equiv V_{\psi\theta}^d (\psi\sigma_\psi)(\gamma\theta)\eta^d$ and $\eta^d \equiv (dz_\psi)(dq)$. Analogue to the FPI scenario, the uncertainty of the foreign productivity has two impacts on the present value of the profit flows: the variation of the foreign productivity κ^a, and the common variation of the foreign and the home productivity κ^b. All necessary information for any decision is included in θ and ψ.

Optimality Conditions with FDI

R&D Investment Following the same steps as in the two previous scenarios, we get the marginal valuation of additional R&D-investment[58]

$$V_\phi^d (\gamma\theta) = \frac{1}{\lambda} \left[1 - \frac{r_\phi^h - \omega r_\phi^d}{\omega} - \varkappa \right].$$ (2.69)

First, there is an additional impact of FDI on the marginal valuation of R&D-investment. It is a very small positive effect through a slight increase in the foreign revenue. In comparison to the isolated home-scenario, this marginal change in r^d again increases the marginal valuation of R&D-investment.

Secondly, the influence of ϕ on the foreign productivity is included in $\varkappa \equiv \frac{\partial \kappa^a}{\partial \phi} + \frac{\partial \kappa^b}{\partial \phi}$. The sign of $\varkappa$ is not definite. The degree $(\frac{1}{a})$ of the home productivity influence on foreign revenue is decisive for $\varkappa$.

Proposition 1 *If $a > 1$ (low control over foreign firm - low impact of θ on r^d) then in both cases, eastern and southern FDI, $\varkappa > 0$ holds. If $a < 1$ and additional R&D exceeds the revenue losses caused by reduced capital input in FDI, then with FDI in the East $\varkappa > 0$ and $\varkappa < 0$ for southern FDI.[59], [60]*

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[58] Again, the time indices are dropped for the simplification of the equations.

[59] If the additional R&D investment increases productivity less than it reduces the additional return by reducing the available capital input for production, $\varkappa$ changes its sign according to the respective FDI location. However, in the case with low control ($a > 1$) the impact of $\varkappa$ on the R&D valuation stays unchanged.

[60] A different assumption about the impact of foreign productivity ψ changes these effects. If additional productivity shows decreasing additional effects, ψ^β with $\beta < 1$ then even with low impact of the domestic firm on the foreign firm, $(a > 1)$, $\varkappa < 0$ with eastern and southern FDI. Thus, FDI increases the valuation of domestic R&D. Based on the same assumption but with high impact on the foreign firm, $(a < 1)$, in the case of eastern FDI $x > 0$ and $\varkappa < 0$ for FDI in the South. In particular, R&D valuation increases with FDI in the South as technology transfer is facilitated and FDI in the East does not yield additional returns for further R&D investment.

With low impact on the foreign firm, the valuation of domestic R&D-investment decreases with FDI. It does not matter whether FDI would be located in the East or in the South. If the domestic firm has a high impact on the foreign firm, southern FDI enhances the R&D valuation. FDI in the East does not change its impact on the R&D valuation. The technology transfer with horizontal FDI in countries with differing production and cost structures is rather complicated and depends strongly on the cost structure of the different countries.[61] Therefore, the implementation of new technologies - developed for domestic production - in the South is only possible with a strong control position or a high impact of the domestic productivity on the foreign firm. Based only on these conditions, additional R&D investment induces additional valuation in the case of southern FDI. FDI in the East does not increase the R&D valuation neither with a high nor with low impact on the foreign firm. In this case, additional capital is rather invested in FDI production directly than into domestic R&D-investment. As Home and East are very similar countries, additional R&D investment accounts for an investment similar to investment in FDI. This FDI implies additional productivity by adding the foreign productivity to the already existing domestic productivity. Such a productivity push caused by additional FDI increases the valuation of FDI and decreases the R&D valuation.

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[61]   Grossman, Helpman and Szeidl (2003) show that under different cost structures in the observed countries, firm strategies change from horizontal to vertical FDI and vice versa.

Home Production   As expected from the previous section, home production stays unchanged again

$$V_h^d(\gamma\theta) = V_h^d(\theta) - \frac{1}{\lambda}\left[\frac{r_h^h(\theta)}{\omega}\right].$$ (2.70)

Substituting equation (2.69) into the marginal valuation of investment in home production delivers

$$V_h^d(\theta) = \frac{1}{\lambda}\left[1 + \frac{r_h^h - r_\phi^h - \omega r_\phi^d}{\omega} - \varkappa\right].$$ (2.71)

The changes in ϕ affect directly the FDI revenue and indirectly the variations of the productivity of FDI. The reduction of the marginal valuation of the investment in home production is not as high as under FPI. In the current case, not only does R&D-investment diminish the capital available for FDI, it also increases the productivity of capital invested in the foreign firm. Furthermore, the sign of $\varkappa$ depends on the FDI location.

FDI   To derive the optimality condition for FDI, we differentiate (2.68) with respect to k^d. This yields

$$V_d^d(\gamma\theta) = V_d^d(\theta) - \frac{1}{\lambda}\left[r_d^d + \kappa_d\right].$$ (2.72)

Equation (2.72) shows that the marginal valuation of FDI in case of successful R&D-investment depends again on the FDI location. If the firm invests in eastern FDI then the term in the brackets remains positive and hence reduces the valuation. On the other hand, if the firm undertakes southern FDI, the sign of κ changes. But the indirect effect through κ is weaker than the direct effect of the changed revenue. Thus, the valuation is still reduced but not as much as in the case of FDI in the East. Generally, we find a decreasing marginal product of capital either invested in domestic production or invested in foreign production.

However, a negative correlation between domestic and foreign productivity at hand, the decrease of the marginal product invested in FDI is dampened.

FDI vs Home

Table (2.7) summarizes the optimality conditions with FDI:

R&D	$V_\phi^d\left(\gamma\theta\right)=\frac{1}{\lambda}\left[1+\frac{\omega r_\phi^d-r_\phi^h}{\omega}-\varkappa\right]$
Home	$V_h^d\left(\gamma\theta\right)=\frac{1}{\lambda}\left[1+\frac{\omega\left(r_d^d+r_\phi^d\right)-r_h^h-r_\phi^h}{\omega}-\varkappa+\kappa_d\right]$
FDI	$V_d^d\left(\gamma\theta\right)=\frac{1}{\lambda}\left[1+\frac{r_h^h+\omega\left(r_\phi^d-r_d^d\right)-r_\phi^h}{\omega}-\varkappa-\kappa_d\right]$

Table 2.7. Optimality Conditions with FDI

As discussed above, FDI impacts the marginal valuation of R&D-investment (first row of Table (2.7)). This effect depends on the impact degree of the domestic productivity on the foreign revenue. With low domestic impact on r^d, FDI decreases the valuation of R&D in either location. High domestic impact on r^d changes the impact of southern FDI on R&D-valuation. The results of domestic R&D-investment are easily transferred to the foreign firm. Not only does R&D increase the domestic productivity but it also boosts the foreign return by increasing the transferred productivity. Furthermore, these effects carry over to the valuation of investment in home-production with respect to R&D-investment. From the second row of Table (2.7), it is obvious how the valuation of capital invested in home production depends on the different effects of FDI. Additional capital invested abroad decreases the marginal revenue of FDI regardless of the firm undertaking southern or eastern FDI. This effect increases the valuation of investment in domestic production. Similar

to R&D, FDI impacts the valuation of domestic production indirectly by the common variation of foreign and home productivity $\varkappa$.

The last parameter in the home valuation stands for the variation of one additional unit capital invested in FDI. Analogue to the FPI scenario, FDI in the East adds further variations. The valuation of home production increases with further eastern FDI. In this case, home production is a very close substitute for FDI and even a more secure source for future capital flows. FDI in the south adds variations not common to the home variations. Thus, home production is not a close substitute for southern FDI as additional - albeit minor - gains on risk diversification arise with southern FDI.

The marginal valuation of FDI with respect to R&D (row three, Table (2.7)) equals a perpetual flow of the difference of changed revenues through additional capital invested in FDI and R&D, discounted by the probability of successful R&D-investment. The hedging components impact the FDI valuation in the same way as the R&D-valuation.

Finally, with isolated FDI the preferred location depends on the impact degree of home productivity on foreign revenue - or rather on the control degree of the investor. High control investors prefer southern FDI and low control investors are indifferent between eastern or southern FDI.

2.3.4 Home and Combined International Investment

Finally, we analyse a combined international investment strategy for the firm. Besides the usual home activities of the firm, it invests in FPI as well as in FDI at the same time. Because there are four different investment alternatives for capital, (2.40) changes to

$$K_t = k_t^h + k_t^p + k_t^d + \phi_t. \tag{2.73}$$

The return functions of the international investments are similar to the return functions under isolated international investment. Hence, the firms' profit function with combined international investment is[62]

$$\pi_t^c (\theta_t) = p_t \theta_t \left(k_t^h\right)^\alpha - \left\{ f^h + \frac{x_t^h}{\theta_t} + \phi_t \right\} + r_t^p - f_t^p + r_t^d - f_t^d. \tag{2.74}$$

and the dynamic firm problem is:[63]

$$\rho V^c (\theta) \, dt = \max_{k^h, k^p, k^d, \phi} \left[\pi^c (\theta) \, dt + E_t (dV^c) \right]. \tag{2.75}$$

The control variables in the dynamic combined optimization problem are the various investment purposes: investment in domestic production k^h, R&D-investment ϕ and the two international investment alternatives FPI k^p and FDI k^d. Furthermore, in the combined scenario, the present value of the firms capital flows is a function of the three state variables: home productivity θ, productivity of the portfolio investments μ and the productivity of the direct investment ψ. These three variables summarize all the necessary information for an optimal investment-decision in the present period. We need the functional equation of the optimizing problem (2.75) to derive the optimality conditions. Again, the steps are very

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[62] We have to keep in mind that $f^d > f^p$ still holds.

[63] We will keep the detailed transforming-steps very short, as the necessary steps for the transformation are similar to the steps undertaken in the previous isolated section.

similar to the isolated investment strategies and therefore, we neglect them and directly turn to the functional equation

$$\rho V^c(\theta) = \max_{k_t^h, k_t^p, k_t^d, \phi_t} \left[\pi_t^c + \lambda \left[V^c(\gamma_t \theta_t) - V^c(\theta_t) \right] + \varepsilon + \kappa + \xi \right] \tag{2.76}$$

where $\xi \equiv V_{\mu\psi}^c (\mu\sigma_\mu)(\psi\sigma_\psi)\eta^c$ and $\eta^c \equiv (dz_\mu)(dz_\psi)$. In (2.76) we have the investment effects of the isolated international strategies combined. Additionally, the common variation of the two international investments is included through ξ.

Optimality Conditions with Combined International Investment (CII)

R&D Investment Following (2.76), the optimality condition for R&D-investment changes slightly in comparison to the isolated scenarios:[64]

$$V_\phi^c(\gamma\theta) = \frac{1}{\lambda} \left[1 - \frac{r_\phi^{hc} - \omega r_\phi^{dc}}{\omega} - \Phi - \varkappa - \xi_\phi \right]. \tag{2.77}$$

The first part of the bracket stays unchanged. Also, the isolated effects of the different investment possibilities, Φ and $\varkappa$, are the same as above. But the interaction of FPI and FDI changes the impact of the isolated investment effects. The only new term is ξ_ϕ. Its impact depends on the international investment interaction too. Table (2.8) summarizes the effects from the isolated strategies and adds the common effects in case of CII.

From Table (2.8), we can emphasize two cases. The first case is a domestic firm with low influence on the foreign revenue (or low productivity). According to Table (2.8), there is no directly dominant strategy with respect to FDI. FDI in the East has the same impact on R&D-valuation as FDI in the South. However, combining FDI and FPI effects on the R&D-

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[64] For simplification, time indices are dropped.

	impact FPI	impact FDI low control	impact FDI high control	common impact
eastern country FPI / eastern FDI	$\Phi > 0$	$\varkappa > 0$	$\varkappa > 0$	$\xi_\phi > 0$
southern country FPI / southern FDI	$\Phi < 0$	$\varkappa > 0$	$\varkappa < 0$	$\xi_\phi > 0$
eastern country FPI / southern FDI	$\Phi > 0$	$\varkappa > 0$	$\varkappa < 0$	$\xi_\phi < 0$
southern country FPI / eastern FDI	$\Phi < 0$	$\varkappa > 0$	$\varkappa > 0$	$\xi_\phi < 0$

Table 2.8. Impact of different International Investment Possibilities

valuation shows that the combination with FPI in a southern country and FDI in the East has a slightly higher positive impact on the R&D valuation. With FPI in an unrelated country, the firm secures risk diversification. Isolated FDI in the East is not better than isolated FDI in the South, but in combination with southern FPI both investment possibilities are negatively correlated and this pushes the marginal valuation of R&D-investment further.

The second case is a firm with high influence on the foreign revenue (or high productivity). The preferred FPI location stays unchanged, whereas FDI switches to the South. Now, technology transfer is easily possible via FDI. As in the former case, FPI still serves as a diversification instrument for domestic risk. It does not hedge FDI-location risk anymore. But with the increasing domestic productivity and its higher impact on foreign revenue, the remaining share of FDI location specific risk diminishes.

Home Production Analogue to the isolated investment possibilities, the impact of home production does not change

$$V_h^c \left(\gamma \theta \right) = V_h^c \left(\theta \right) - \frac{1}{\lambda} \left[\frac{r_h^{hc} \left(\theta \right)}{\omega} \right]. \tag{2.78}$$

In combination with the marginal valuation of R&D-investment, the impact of CII on the home production valuation becomes clear:

$$V_h^c \left(\theta \right) = \frac{1}{\lambda} \left[1 + \frac{r_h^{hc} - r_\phi^{hc} - r_\phi^{dc}}{\omega} - \varkappa - \Phi - \xi_\phi \right]. \tag{2.79}$$

We see from Table (2.8), that the optimal investment combinations with respect to R&D-investment are the optimal combinations with respect to the valuation of home production in combination with R&D. But we still cannot generalize this optimal investment combination.

CII First, we have to examine the effects on the various international investments and the combination of all effects. As they are all derived similarly from the isolated strategies, Table (2.9) just summarizes the results

R&D	$V_\phi^c \left(\gamma \theta \right) = \frac{1}{\lambda} \left[1 - \frac{r_\phi^{hc} - r_\phi^{dc}}{\omega} - \Phi - \varkappa - \xi_\phi \right]$
Home	$V_h^c \left(\gamma \theta \right) = \frac{1}{\lambda} \left[1 + \frac{r_d^{dc} + r_\phi^{dc} - r_h^{hc} - r_\phi^{hc}}{\omega} - \varkappa - \Phi + \varepsilon_p + \kappa_d - \xi_\phi + \xi_d \right]$
FDI	$V_d^c \left(\gamma \theta \right) = \frac{1}{\lambda} \left[1 + \frac{r_h^{hc} - r_\phi^{hc} + \omega \left(r_\phi^{dc} - r_d^{dc} \right)}{\omega} - \Phi - \varkappa - \kappa_d - \xi_\phi - \xi_d \right]$
FPI	$V_p^c \left(\gamma \theta \right) = \frac{1}{\lambda} \left[1 + \frac{r_h^{hc} - r_\phi^{hc} + \omega \left(r_\phi^{dc} - r_p^{pc} \right)}{\omega} - \varkappa - \Phi - \varepsilon_p - \xi_\phi - \xi_p \right]$

Table 2.9. Optimality Conditions with CII

From Table (2.9), we see that each marginal valuation increases with negative correlation of the home industry and the chosen industry for FPI ($\Phi < 0$). The risk of unsuccessful R&D-investment at home can be propped up by the short term portfolio-investment.

To detect the preferred FDI location, again we have to distinguish two cases: low and high impact on the foreign firm. With low productivity and low control, $\varkappa > 0$ reduces the respective valuation. The positive sign for $\varkappa$ arises under eastern as well as southern FDI. Overall, there is no facilitated technology transfer under eastern or southern FDI. However, FDI in the East is negatively correlated with the chosen FPI location. This variation effect dampens the direct negative FDI impact on the respective valuations. Hence, both international investments are mostly favoured with FPI in the southern and FDI in the eastern country. For FPI, the risk diversification is the stronger effect with the highest impact on the firm decision. In particular, FPI is the more flexible investment and can be adjusted with only minor costs. Therefore, it is the appropriate instrument to diversify a firm's risk. On the other hand, FDI reacts more sensitive by productivity changes, thus being the favourable instrument to exploit productivity gains internationally. The additionally arising negative correlation between the two international investments pushes all valuations slightly up.

With high domestic control over the foreign firm, the preferred FDI location switches from the East to the South. High control (low a) reduces the share of location or industry specific risk and facilitates the technology transfer from home to the South.[65] FPI loses its function of direct-hedging FDI location specific risk. But, FPI still works as hedging

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[65]   A high home productivity θ has equivalent consequences.

instrument for R&D risk. With the increasing domestic control - and therefore higher impact of θ on the FDI revenue, this role even gains more importance. Higher domestic productivity requires higher R&D-investments and this in turn stipulates a more intensive risk hedging. Concluding, FPI loses its impact as direct hedging instrument with respect to FDI but with respect to domestic production, and thus indirectly to FDI, the hedging necessity increases.

In CII, FPI can prop up the risk from home production and FDI. The relations between the home country and the recipient countries are unchanged to the isolated investment scenarios for FPI as well as for FDI. Hence, we expect in CII the share of FPI to adjust to short-term environment changes whereas FDI stays unchanged. Because of the complexity of the problem there is no possibility to derive an explicit analytical solution for the respective international investment shares. The shares of FPI and FDI will be derived numerically.

2.4   Optimal Investment Strategies

As for both FDI investor scenarios - low and high control on the foreign firm, the results emphasize that FPI works as a diversification instrument and the firm uses FDI as a technology transfer channel. These findings are valid for the isolated strategies as well as for the combined strategy. To prove or reject these findings clearly in the following analysis, we consider FDI in the East and FPI in the South.

Unfortunately, the problem has no traceable closed form solution. Hence, the solution must be approximated by numerical methods. We break the model down into many

one-period decisions. We use a recursive policy function iteration.[66] We take a given capital stock and assume a certain choice of the amount of capital the firm invests in home production. The firm derives the further investment decisions according to the optimality conditions displayed in the tables (2.6), (2.7) and (2.9). From a given capital stock $K = 10$ for every period we set the choice for investment in domestic production k^h. The remaining decision variables are a result of the optimality conditions. We repeat this procedure with various values for k^h. The initial value of θ is set to one and changes according to the R&D-investment decision. Additionally, we examine different cost structures. The varying cost structures change the results in terms of their value but they never have an impact on the bottom line of the results. We test the model with different time horizons: 10, 20, 30, 40, 50 periods. There are some small variations in the absolute investment values but the length of the time horizon does not change the main results either. The results are only sensitive to productivity strength and correlation of the international investments. This is discussed in the following sections. Variations of the success probability of the R&D investment λ, the depreciation of capital τ and the productivity θ and their impact on the results are examined thourought the analysis.

The first run computes the solution for the isolated international investment strategies and determines the cut-offs at which the firm changes from one strategy to another (home, FPI or FDI). In the second run, we repeat the same steps for the combined international investment strategy. Precisely, with CII the firm changes its strategy only once: from isolated home production to FPI and FDI at the same time.

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[66]   For detailed discussion and mathematical background see Adda and Cooper (2003), Judd (1998) and Dixit and Pindyck (1994).

We derive a benchmark case with a depreciation of $\tau = 0.3$. A higher depreciation pushes the start of international activity backwards in time and a lower depreciation pulls it forward. The general results stay the same. Furthermore, the probability for successful R&D-investment λ varies and shows a significant impact on the firms' decision to invest internationally or not.

2.4.1   Isolated International Investment

Start of International Activity

The first international activity of the firm is FPI. As expected, FPI requires lower cut-off productivity than FDI. However, the firm does not start investing in FPI until the probability of successful R&D is 0.3 or higher. The figures (2.1) and (2.2) show, for example, the investment shares of all four investment possibilities over time. The time horizon is set for 10 periods. In figure (2.1) the R&D-success probability is $\lambda = 0.3$ and it is $\lambda = 0.5$ in (2.2). The firm always starts off with investments in home production and home R&D only. After some periods of R&D investment, the productivity of the firm is high enough and the firm starts to invest internationally. In case of figure (2.1) the first international investment (FPI) is done in period 5 at a productivity of $\theta = 1.08668$. In the following period, the R&D investment increases and consequently increases as well to $\theta = 1.35727$. Then the firm switches from FPI to FDI.

Even with $\lambda = 0.5$, the international activity starts very late in time. Figure (2.2) shows that the first international investment happens in period 3. With increasing R&D-

probability, the firm undertakes international investment at an earlier stage in time and with

lower productivity $\theta = 1.07122$. Again, with increasing R&D investment and increasing θ

the firm then switches to FDI in period 4. All this is very intuitive, as with high success-

probability the productivity increases more quickly. All these results confirm the findings

in the recent literature. Firms with low productivity, stay isolated at the home market. With

a slight increase in productivity the first small international steps are made and finally, firms

with a remarkable high productivity invest in FDI.
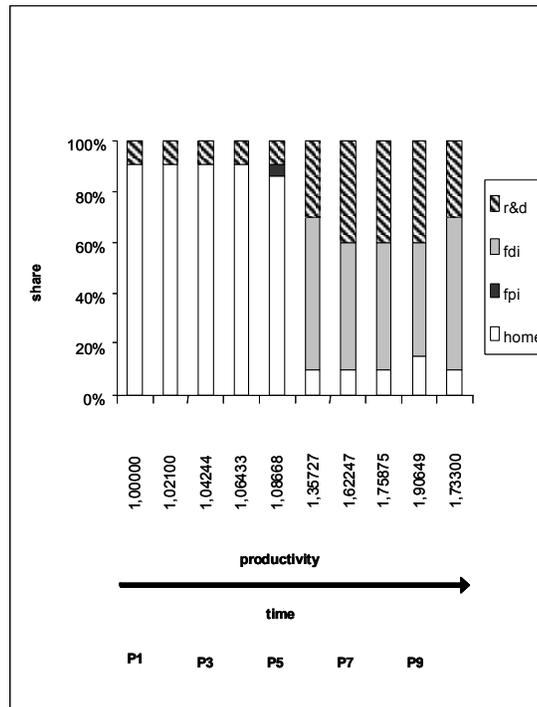
Fig. 2.1. Isolated Investment Shares with $\lambda = 0.3$

Furthermore, the figures (2.1) and (2.2) show that not only is FDI undertaken with

a high productivity, there is also a reversed relationship. As soon as the firm invests in

FDI, the R&D investment increases and this in turn boosts the productivity θ. Thus, with
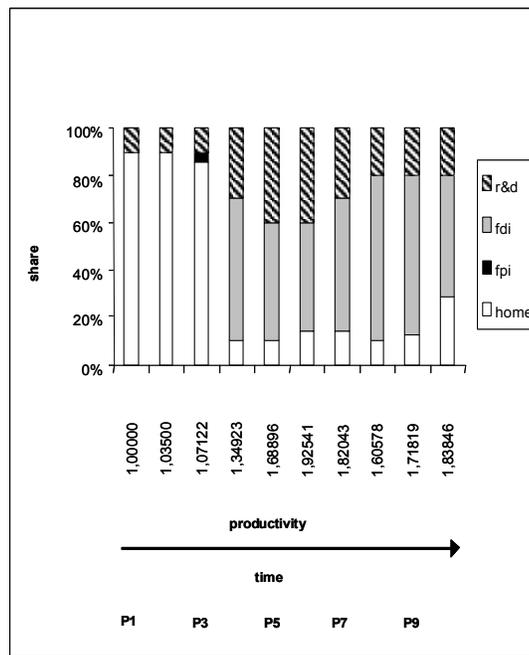
Fig. 2.2. Isolated Investment Shares with $\lambda = 0.5$

the additional investment abroad, investment in R&D is more valuable than without the direct investment. The incentive to invest in R&D increases because a higher domestic productivity now pushes not only the domestic output and return but also the return of the foreign direct investment. However, this effect diminishes with time. Each additional investment in R&D adds less productivity for each unit capital invested in home and foreign production. Consequently, the firm will draw capital from R&D investment and invest it in additional FDI and later on even in additional home production. Again, the figures (2.1) and (2.2) show the increasing share of FDI and the late increase in home production in the firm's total investment.

Variation of Foreign Productivity

Firstly, we examine changes in the FPI productivity. Table (2.10) shows that neither the productivity cut offs nor the cut-off time change with variations in FPI productivity.[67] One might have expected that with higher foreign productivity the firm engages earlier in international investment. This is not the case. The firm first secures the home production process and then goes abroad.

	Switch-Period FPI	Productivity of FPI	Share of FPI	Switch-Period FDI	Productivity of FDI	Share of FDI
$\lambda = 0,3$	5	1,087	0,352	6	1,36	6,0
low fpi	x	x	x	x	x	x
high fpi	5	1,087	0,84	6	1,36	6,0
$\lambda = 0,4$	4	1,086	0,36	5	1,38	6,0
low fpi	x	x	x	x	x	x
high fpi	4	1,086	0,85	5	1,38	6,0
$\lambda = 0,5$	3	1,07	0,41	4	1,35	6,0
low fpi	x	x	x	x	x	x
high fpi	3	1,07	0,92	4	1,35	6,0
$\lambda = 0,6$	3	1,09	0,37	4	1,59	5,0
low fpi	x	x	x	x	x	x
high fpi	3	1,09	0,86	4	1,59	5,0
$\lambda = 0,7$	2	1,05	0,5	3	1,21	7,0
low fpi	x	x	x	x	x	x
high fpi	2	1,05	1,04	3	1,21	7,0
$\lambda = 0,8$	2	1,06	0,48	3	1,36	6,0
low fpi	x	x	x	x	x	x
high fpi	2	1,06	1,01	3	1,36	6,0

Table 2.10. Productivity Cut-Offs and Changing Investments with varying FPI Productivity

Furthermore, the firm does not reduce or increase its share in FDI. Only the FPI shares increase with higher FPI productivity. This might seem intuitive, as only the FPI-productivity changes. Hence, the FDI shares are independent of the FPI productivity. A

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[67] In Table (2.10) the Switch-Period is the period in which the firm engages in FPI or FDI for the first time.

closer look on FDI-productivity changes shows whether this independence also holds in the opposite direction and we can confirm FPI as the more flexible instrument.

Table (2.11) compares the firms' international investment with high and low FDI productivity.[68] It shows that the firm engages in international investment earlier in time with a high FDI-productivity than with a lower FDI-productivity. Furthermore, the productivity cut-off is lower than with the benchmark productivity. The only exceptions are the cases with a very high success probability of R&D investment. For these cases the cut-offs are the same as for the benchmark case and the high FDI-productivity.

	Switch-Period	Productivity	Share	Switch-Period	Productivity	Share
	FPI	of FPI	of FPI	FDI	of FDI	of FDI
$\lambda = 0,2$	x	x	x	x	x	x
low fdi	x	x	x	x	x	x
high fdi	2	1,01	0,6	3	1,28	8,0
$\lambda = 0,3$	5	1,087	0,352	6	1,36	6,0
low fdi	x	x	x	x	x	x
high fdi	2	1,02	0,58	3	1,04	8,0
$\lambda = 0,4$	4	1,086	0,36	5	1,38	6,0
low fpi	x	x	x	x	x	x
high fpi	2	1,03	0,56	3	1,06	8,0
$\lambda = 0,5$	3	1,07	0,41	4	1,35	6,0
low fpi	x	x	x	x	x	x
high fpi	2	1,04	0,54	3	1,07	8,0
$\lambda = 0,6$	3	1,09	0,37	4	1,59	5,0
low fpi	x	x	x	x	x	x
high fpi	2	1,04	0,52	3	1,09	8,0
$\lambda = 0,7$	2	1,05	0,5	3	1,21	7,0
low fpi	x	x	x	x	x	x
high fpi	2	1,05	0,5	3	1,21	7,0
$\lambda = 0,8$	2	1,06	0,48	3	1,36	6,0
low fpi	x	x	x	x	x	x
high fpi	2	1,06	0,6	3	1,36	6,0

Table 2.11. Productivity Cut-Offs and Changing Investment Shares with varying FDI Productivity.

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[68] In Table (2.11) the Switch-Period is the period in which the firm engages in FPI or FDI for the first time.

Finally, with varying FDI-productivity both international shares change in comparison to the benchmark case. In particular, the FPI shares do not only vary in comparison to the benchmark case. They also change between the various cases of high FDI-productivity while the FDI shares stay almost the same. Again, only with the high R&D-probability the FDI shares change between the different cases, but they do not change with respect to the benchmark case. So, we find again FPI as the flexible instrument adjusting to short-term changes while FDI reacts more sluggishly. Note that these are only results for the isolated investment scenario.

2.4.2   Combined International Investment

In contrast to the isolated international investment strategy, in the combined investment scenario the firm starts its international activities with both investment alternatives FPI and FDI at the same time. In Figure (2.3) the first international acitivities of both investment scenarios are compared. For the isolated investment strategy, the first international activity is FPI. For the combined investment strategy, the first international activity is FDI. Both international investments are compared in dependence of the R&D success probability λ. The pink dots depict the period in which the firm switches from only home production to its first international investment in the isolated investment scenario - FPI. The blue dots show the period in which the firm takes its first international steps in the combined international investment scenario - FDI. Figure (2.3) shows that even with a low R&D-probability, the firm engages in its first international investment. However, we have to distinguish between the first international investment and the investment in FDI. In both cases, the first

international activity under CII (CII FDI and FPI vs isolated FPI) takes place at an earlier

date in time than the first international firm activity under an isolated international invest-

ment strategy. Additionally, the first international activity requires a lower R&D success

probability under CII than for the isolated international investments.

At a moderate probability, the firm switches from home to international investment

(isol. FPI and combined FPI-FDI respectively at the same time). With increasing probabil-

ity, the isolated investment even dominates the combined strategy in time. It is important

to keep in mind that in the current situation a firm starting isolated FPI is compared with a

firm starting combined FPI and FDI at the same time.
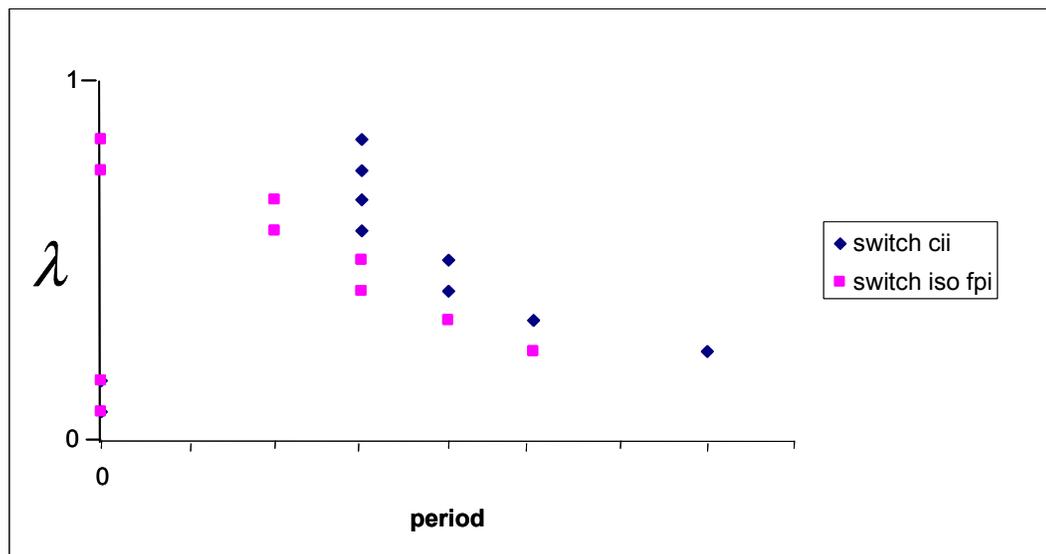
Fig. 2.3. First International Investment

Now, we turn to the comparison of isolated FDI and the combined international in-

vestment. For the switch to FDI the picture changes as shown in Figure (2.4). In Figure

(2.4) the first investment in FDI for the isolated and the combined international investment
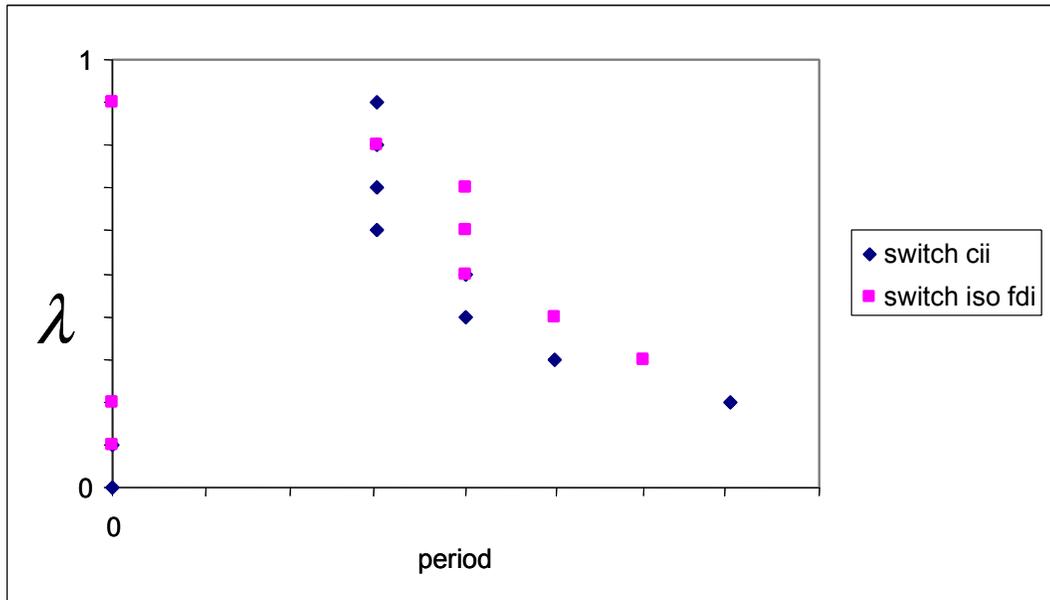
Fig. 2.4. First isolated international investment vs combined FDI

are compared. Both investments are depicted in dependence of the R&D success probability λ. Again the pink dots stand for the period in which the firm switches from only home investment to FDI in the isolated investment scenario and the blue dots show the period of the switch for the combined international investment scenario. Under CII the firm switches from home production to international investment at a lower R&D-probability and at an earlier stage in time. Furthermore, with increasing success-probability, CII still dominates the isolated investments in time.

However, CII does not always dominate isolated FDI in productivity. Particularly, the productivity cut-offs for FDI under CII do not always lie below the cut-offs for isolated FDI. The productivity cut-offs are analysed according to the value of θ at which the firm switches from one strategy (for example home) to another strategy (for example FDI). We compare the marginal impact of θ on the different discounted capital flows under a given

productivity level. The figures (2.5) and (2.6) show the different productivities for FDI cut

off with isolated FDI (iso) and CII-FDI (cii) in dependence of various R&D success prob-

abilities. The pink line resembles the various cut offs in the isolated investment scenario

and the blue line displays the cut-offs for the combined international investment scenario.

In Figure (2.5) productivity of the first FDI for the isolated and the combined international

investment strategy are compared. The R&D success probability varies and a positive cor-

relation between FDI and FPI is assumed. In Figure (2.6) productivities of the first FDI for

the isolated and the combined international investment are compared. The R&D success

probability varies and a negative correlation between FDI and FPI is assumed.
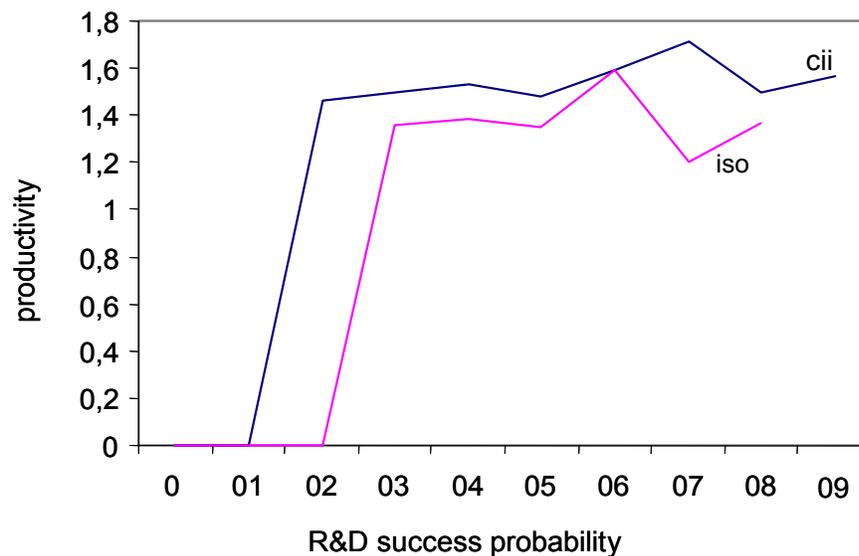
Fig. 2.5. Isolated vs Combined FDI Productivity with positive FDI - FPI Correlation

The dominance of the isolated investment strategy might be unexpected. In the case

of the positively correlated foreign productivities, FPI cannot prop up the FDI variations

directly. But FPI absorbs the variations of the domestic productivity. The firm only invests
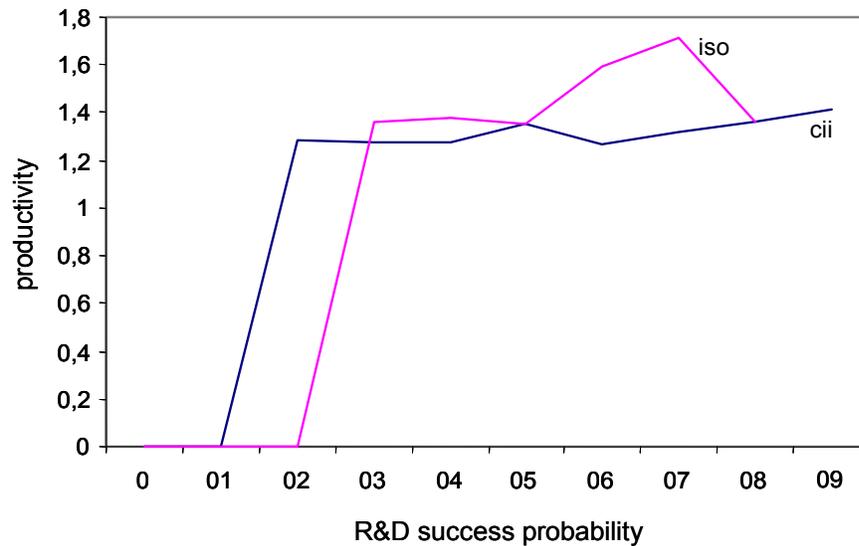
Fig. 2.6. Isolated vs Combined FDI Productivity with negative FDI - FPI Correlation

in southern FDI if it has a high impact on the foreign productivity, hence θ influences significantly the foreign direct return. This in turn transfers the domestic variations into the foreign productivity. These variations constitute a high share of the foreign variation as the impact of θ is high. Since FPI is an effective instrument to dampen the domestic variation resulting from θ, FPI indirectly smoothes variations in the foreign direct return. The incentive to invest in domestic R&D is enhanced by this mechanism and the productivity cut-off is higher than without the combined investment possibility.

In the case of the negative correlation, the productivity cut-offs of both investment strategies are as expected. The isolated cut-off productivity is always higher than the cut-off for the combined international investments. Obviously, FPI props up the FDI variations as well as the variations resulting from domestic productivity uncertainty.

One should not neglect that with positive as well as with negative correlated international investments the combined international investment starts not only earlier in time than the isolated international investment but also at a lower R&D success-probability. Thus, the possibility to use FPI as a financial hedging instrument boosts the value of corporate diversification via FDI. This confirms the results in Table (2.9).

Variation of Foreign Productivity

First of all, minor changes in the foreign productivities relation may diminish completely any international investment under isolated strategy. If both productivities are very low or at least the FPI-productivity is very low, then the firm does not invest abroad. On the other hand, these changes do not reduce totally international investment under CII. The productivity cut-off changes, as both foreign productivities drift apart (negatively correlated) or move together (positively correlated). The following figures (2.7) and (2.8) show the variation of FPI and FDI shares in dependence on their productivity relation. In Figure (2.7) investment shares of FPI in the combined international investment scenario are depicted with a negative (yellow line) as well as positive (blue line) correlation between FPI and FDI. In Figure (2.8) investment shares of FDI in the combined international investment scenario are depicted with a negative (yellow line) as well as positive (blue line) correlation between FPI and FDI.

Overall, the share of FPI varies more through the changed productivities than through the FDI shares. The latter are more stable than the former. Additionally, FPI shares under CII fluctuate even more than under isolated international investment. Hence, with CII
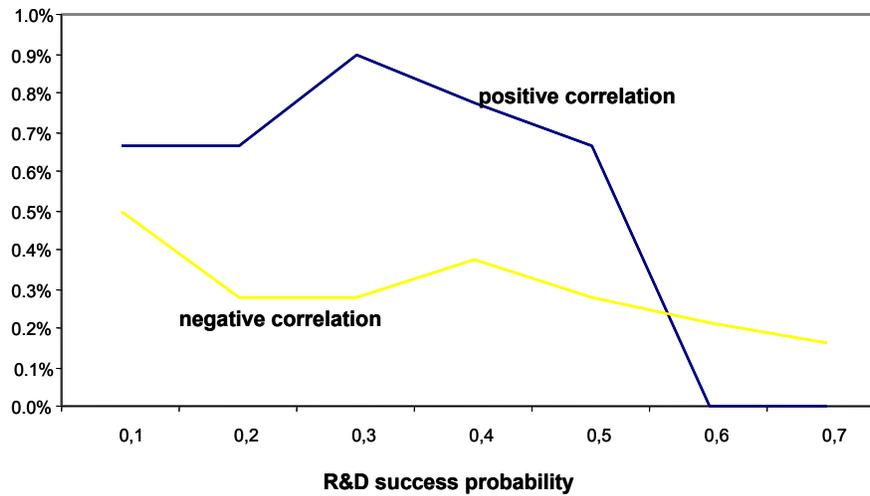
Fig. 2.7. Combined FPI Shares

the firm reacts to short-term changes in its environment by adjusting FPI and keeping FDI stable. Thus, FPI does not necessarily increase with FDI, but adjusts according to R&D-probability, depreciation and variation in home and both foreign productivities. These results confirm again the risk-adjusting task of FPI and the more sluggish technology transfer FDI instrument.
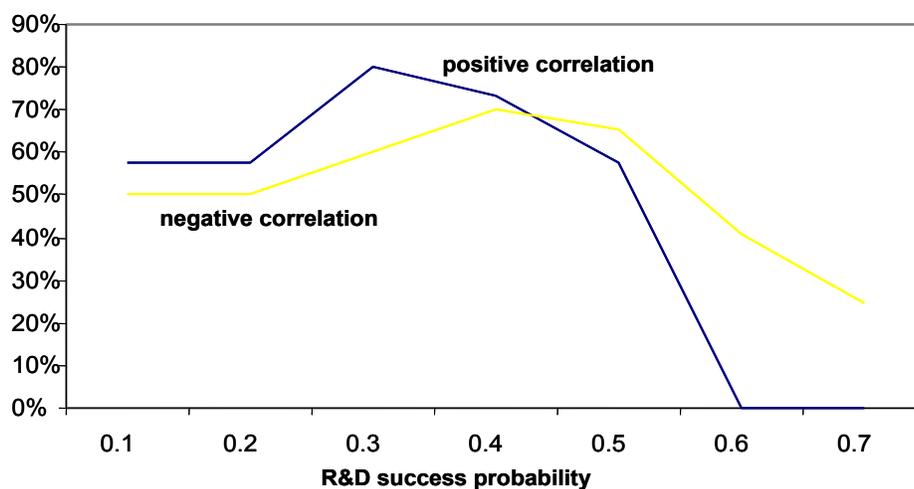
Fig. 2.8. Combined FDI Shares

2.5 Conclusion

This chapter shows that even though the empirical distinction between FDI and FPI is rather

complicated, a differentiation of a firm's motivation to use these investment instruments is

possible.[69] Until now, the existing literature does not take possible effects of the combina-

tion of different investment instruments into account. Furthermore, most analyses are static

and do not emphasize the date at which a firm starts to invest internationally. An early start

in international activities may be important to gain specific market shares and build up in-

ternational reputation before the competitors do. To fill that gap, we examine the relation

of FPI and FDI in a dynamic investment setting. The results indicate that this relation is

rather strategic complementary. Isolated FPI and FDI investments are compared to com-

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[69]   Empirical data for firms' FPI is very hard to obtain. Aggregate portfolio investment data is available on
firm level. The sector or industry of the portfolio investment is not possible to locate because there is no
notification requirement for firms.

bined FPI and FDI investments. The combined investment strategy dominates the isolated investments always in time. Furthermorew, CII comprises a higher incentive to invest in R&D. The existing literature does not allow for this combination of FDI and FPI and only concentrates on isolated FDI. Thus, possible advantages from the combination between different investment instruments are neglected. We find that the risk diversifying effect from additional FPI pushes the marginal valuation of R&D investment above the valuation with isolated investment strategies. As a consequence, home productivity increases much faster and without smaller relative opportunity costs than under isolated investment strategies. Finally, this leads to a higher productivity cut off for FDI but at an earlier date in time. The significant higher CII R&D investment than isolated FDI R&D investment confirms this observation. Surprisingly, this is not only the case with a combination of horizontal FDI in a country with similar structure and FPI in a country with dissimilar structure to the home country, but also with both international investments in a dissimilar country structure to the home structure.

Furthermore, we also find that firms adjust to short-term changes via FPI and keep FDI stable. FPI can prop up small and medium sized changes and therefore, the valuation of FDI with combined FPI is higher than of isolated FDI. Hence, a combined FPI and FDI investment strategy increases the firms' flexibility. A combination of both investment instruments increases the valuation of the respective instruments.

2.6 Appendix

Derivation of Expected Capital Flow

The value of the firm in the case without international investment is a function of the state variable θ (productivity).

$$dV^h = V_\theta^h d\theta \tag{2.80}$$

The state variable follows a Poisson process with $q = 1$ with prob. λdt and $q = 0$ with probability $(1 - \lambda dt)$:

$$\Rightarrow d\theta = \left[(1 - \tau) \frac{\phi}{K} \right] \theta dq. \tag{2.81}$$

According to (2.80), the expected capital flow of the firm $E\left(dV^h \right)$ depends on θ. Using the definition (2.81) of the productivity variation leads to the expected capital flow of the firm:

$$\Rightarrow \quad E\left(dV^h \right) = \quad \underbrace{\lambda \left[V^h \left(\left[(1 - \tau) \frac{\phi}{K} \right] \theta \right) - V\left(\theta \right) \right] dt}_{\text{change of capital flow caused by increased } \theta \text{ weighted with the probability}} \tag{2.82}$$

$$+ \quad \underbrace{(1 - \lambda dt) \left[V^h \left(\theta \right) - V^h \left(\theta \right) \right]}_{\text{change of capital flow in the case of unchanged } \theta \text{ weighted with respective probability}} \tag{2.83}$$

$$\Rightarrow \quad E\left(dV^h \right) = +\lambda \left[V^h \left(\gamma\theta \right) - V^h \left(\theta \right) \right] dt \tag{2.84}$$

with

$$\gamma \equiv \left[(1 - \tau) \frac{\phi}{K} \right] \tag{2.85}$$

For a general discussion of Poisson processes in continuous time, see Dixit and Pindyck (1994).

Derivation of the Profit Function with Variable Revenue

Domestic consumers have Dixit-Stiglitz preferences for differentiated goods with elasticity of substitution $\vartheta = \frac{1}{1-\varphi} > 1$. The price index for the home country is

$$P = \left[\int_{j \in J} p\,(j)^{1-\vartheta}\, dj \right]^{\frac{1}{1-\vartheta}} \tag{2.86}$$

and the demand level is

$$A = \left[\int_{j \in J} x\,(j)^{\varphi}\, dj \right]^{\frac{1}{\varphi}}. \tag{2.87}$$

From (2.86) and (2.87) we derive the demand function

$$x_i = A p_i^{-\vartheta} \tag{2.88}$$

for each good variety produced by firm i. In the following, the firm index i is neglected, as we just analyse one representative firm.

According to (2.42) the profit of the firm in period t equals

$$\pi_t\,(\theta_t) = r_t^h - f_t^h - \frac{x_t^h}{\theta_t} - \phi_t. \tag{2.89}$$

Revenue equals supply multiplied by the price we can rearrange (2.89) to

$$
\begin{aligned}
\pi_t\,(\theta_t) &= r_t^h - f_t^h - \frac{p x_t^h}{\theta_t}\frac{1}{p} - \phi_t & (2.90) \\
\pi_t\,(\theta_t) &= r_t^h - f_t^h - \frac{r_t^h}{\theta_t}\frac{1}{\frac{1}{\varphi\theta_t}} - \phi_t & \\
\pi_t\,(\theta_t) &= r_t^h\,(1-\varphi) - f_t^h - \phi_t & \\
\pi_t\,(\theta_t) &= \frac{r_t^h}{\omega} - f_t^h - \phi_t. & (2.91)
\end{aligned}
$$

Chapter 3
Do Regional Trade and Specialization Drive Intra-Regional Risk-Sharing?

3.1 Introduction

The question whether increasing trade drives convergence or divergence of business cycles, has severe implications for integration processes between countries and regions. With increasing trade integration countries become more and more dependent on their trading partner's economy. Additionally, economic variations may influence neighbour countries through various channels. Hence, this issue has been examined via various approaches. The most prominent ones are the empirical analysis of Frankel and Rose (1998) and the theoretical study by Krugman (1993). The former conclude that increasing trade leads to business cycle convergence between the trading partners. By contrast, Krugman (1993) derives that increasing trade implies higher specialization. Consequently, business cycles of trading partners diverge. Both results have entered the discussions of future possible currency unions or the choice of exchange rate regimes in different regions.[70] Either way, trade and in particular trade patterns within a region and between regions appear to influence the industrial shape of regions. Furthermore, business cycle co-movements depend on the in-

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[70] For example Reisen and van Trotsenburg (1988) discuss a possible peg of Hong Kong, Korea, Singapore and Taiwan to the Yen. Among others they claim insufficient integration between these countries and Japan as an argument against the peg. Busse, Hefeker and Koopmann (2004) analyse the implications of the exchange rate choice on trade integration and appeal of foreign investment flows. They argue in favour of a dual currency board for Mercusor. In particular, the domestic currencies should be pegged to the US-dollar and the Euro, i.e. the two main trading partners.

dustrial specialization and involve different degrees of intra and inter-regional risk sharing. In turn, risk sharing affects shock transmission between countries and, therefore, impacts for example monetary policy decisions as well as exchange rate choices.[71]

The goal of the present chapter is two-fold. First, we explore the impact of different trade patterns on industrial specialization and consequently on business cycle co-movements between and within different regions. We particularly emphasize industrial specialization as a result of intra- or inter-industry trade. Second, we analyse the degree of risk-sharing between and within the regions. In particular, the purpose is to clarify direct and indirect channels between trade, specialization, business cycle co-movements and risk sharing.

The empirical analysis is conducted for Europe, Asia and Latin America. We select Europe due to its high level of integration with its one single market in goods and services. Asia and Latin America are chosen as these economies rapidly increase their shares on the world economy.[72] Moreover, between these three country groupings the process of international integration has taken different forms and different speed. Fishlow and Haggard (1992) state that the European integration is driven by an intrinsic political motivation. This development is said to have happened due to the common institutions of the EU. In contrast, the authors explain that the integration process in Asia or Latin America is mostly driven by economic aspects, for example to constitute a counterweight to an international hege-

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[71] For a detailed discussion of risk sharing and shock transmission among U.S. states see Del Negro (2002). Labhard and Sawicki (2006) provide empirical evidence of higher risk sharing within the United Kingdom than between the United Kingdom and other OECD countries. Additionally, they analyse different channels of risk sharing and their varying relevance over time.

[72] See IMF (2007).

mony. Superior institutions to monitor this integration are rather lacking in Asia or Latin America.[73] The various origins of trade as well as financial integration may have caused the different manifestation of the present integration within the various regions. This may result in different degrees of specialization and risk-sharing within these regions.[74]

Methodically, we follow Imbs (2004) and implement a simultaneous-equation approach to examine the importance of inter and intra-industry trade and its impact on specialization and risk sharing between the country groups. The application of 1 digit industry trade data and total trade data allows for analysing different trade patterns between regions and within regions. According to the literature, the business cycle convergence or divergence mainly depends on the specialization pattern within the examined region. Hence, we distinguish between similar specialization and asymmetric specialization within a country group. It is to be expected that countries within a region with homogeneous specializations show intra-industry trade. Hence, regional business-cycles converge. Consequently, risk-sharing within these regions is not possible. These countries tend to be more internationally financially integrated than regionally. Inter-industry trade arises in countries within regions with heterogeneous specialization. As a result, regional business-cycles diverge and countries can share risk within the region. Regional financial integration is stronger for these countries than international financial integration. Additionally, we study whether the same patterns create risk sharing also in the means of consumption co-movements between or within a region.

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[73]   For a detailed discussion on this subject, see also Mukhametdinov (2007) or Eichengreen and Park (2003).

[74]   See also Eichengreen and Park (2003) for a detailed discussion of the different factors causing dissimilar degrees of financial integration for Europe and Asia.

We follow the recent literature by combining financial, industry trade data and business cycles as the simultaneous explaining variables. In contrast to other studies, our empirical analysis also controls for different levels of risk sharing within a simultaneous equation model of trade, industrial specialization, financial integration and business cycle co-movements. The direct and indirect channels of inter- or intra-regional risk sharing with simultaneous trade and financial integration as well as industrial specialization and business cycle co-movements are widely unexplored yet. Moreover, we compare not only two but three large regions exhibiting different motivations and stages of financial and economic integration. As the following literature shows, different country groups like OECD or non-OECD countries not only react differently to variations in trade structure, specialization and financial integration, but also show differing sensitivity to industry or country shocks. Thus, with the comparison of three different country groupings, we emphasize the varying impact of trade, specialization, business cycles and financial integration. This in turn might shed some light on the different transmission channels for economic shocks between these dissimilar country groupings.

The remainder of Chapter 3 is organised as follows. Section 2 links the issue to the recent literature and derives two hypotheses. Then, we describe the methodology and the data in section 3. The discussion of the results and their robustness follows in section 4 and 5. Finally, section 6 summarizes and concludes Chapter 3.

3.2 Theoretical Foundation

The increasing international integration has lead to an increased importance of business cycle co-movements. The transmission channels especially of shocks between countries and regions are a feature of the business cycle mechanisms that needs to be considered. Exploring the impact of trade and specialization on business cycle co-movements between countries and regions might help to understand how policy makers should react to economic shocks in neighbouring countries. Frankel and Rose (1998) suggest in an empirical approach of twenty-one countries from 1959 - 1993 that, under the assumption of dominant demand shocks and a high share of intra-industry trade, business cycles converge with increasing trade and financial integration between trading countries. Heathcote and Perry (2003, 2004) argument in the opposite manner. The authors state that from 1960 to 2002 the U.S. business cycle has become less correlated with the business cycles in the rest of the industrialized world.[75] They refer this change in business cycle co-movement to increasing financial integration and less correlated shocks. Furthermore, the authors disentangle two opposed effects of financial integration on consumption co-movement between countries. Firstly, financial integration increases consumption correlation if financial markets are used to smooth the optimal consumption path through time. Secondly, financial integration decreases consumption correlation if financial markets are used to adjust the optimal composition of foreign and domestic goods in the consumption bundle. The present

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[75]   "The rest of the world" in the analysis of Heathcote and Perry (2003, 2004) consists of 15 European Union countries and Japan.

analysis considers these different aspects. Additionally, we analyse the impact of financial market variables on consumption risk sharing as well as on business cycle co-movements.

Campa and Fernandes (2006) analyse the development of country and industry shocks as impact factors on portfolio returns for 48 countries from 1990 to 2000. The impact of both factors on portfolio returns depends strongly on the international integration of the respective country or industry. Their main result is that the driving force behind the rise of global industry shocks is the financial market integration. On the country level, they find a higher correlation between the country's business cycle and the world's business cycle with higher economic integration. Precisely, for poor countries the importance of country factors decreases with the degree of international financial integration. Yet, in general, the impact of country factors rises with a high degree of specialization and active financial markets. Furthermore, with increasing economic integration and trade, the magnitude of industry shocks increases and that of country shocks decreases. Rose and Spiegel (2007) state a positive correlation between remoteness from financial activity, proxied by the distance to major international financial centres, and macroeconomic volatility. Even though their results are sensitive to changes in the country selection, they conclude that financial integration as well as geography matter for business cycle behaviour. This again indicates that identical factors cause different developments in dependence of the country characteristics. Therefore, the major country groups in the present sample, Europe and Latin America, are each subdivided in two smaller parts: Europe Core and Europe CEEC; Latin America Central and Latin America South. This approach is supposed to clarify the dif-

ferent reactions of the different country groups to the impact of trade, specialization and financial integration.

The impact of business cycle co-movements on financial risk-sharing as well as on consumption risk-sharing between countries might serve as an explanation on how shocks may be absorbed through these channels, since risk-sharing can substitute for missing mechanisms like exchange rate volatility or labour mobility. Labhard and Sawicki (2006) analyse the degree and channels of risk sharing within the United Kingdom and between the United Kingdom and OECD from 1970 to 2001. They indicate that risk sharing within the United Kingdom is higher than between the United Kingdom and OECD. Additionally, they find that at the regional level, the main fraction of risk is shared through cross-regional asset holdings. At the international level, risk sharing takes place via borrowing and lending. One further result of their study is that even though the role of capital markets for risk sharing has increased, the overall degree of risk sharing has declined over time. Kim and Sheen (2006) examine the risk sharing channels within Australia and between Australia and New Zealand from 1960 to 2002. They explicitly distinguish between the different possible channels like risk sharing via market mechanisms, fiscal policy or labour mobility. One result of their study is that capital and credit markets are the main risk sharing channel. Direct fiscal policy amplifies idiosyncratic shocks across Australian states only to relatively low degree. However, the increasing importance of capital and especially credit markets since 1992 might be interpreted as a result of financial market deregulations of the Australian government. Shin and Sohn (2005) evaluate the effects of financial and trade integration on business cycle co-movements in East Asia over the years 1971 - 2003. They

compare the integration impact on consumption co-movement in comparison to the impact on output co-movements. The authors conclude that trade integration enforces output co-movement but financial integration does not. Furthermore, they state that increasing trade does not enhance consumption co-movement or risk-sharing. One of their assumptions is that trade liberalization tends to take place at the regional level more intensively. In contrast, financial integration is not supposed to be regionally boosted, because financial assets are weightless.

One important factor for business cycle co-movement between different countries is the degree of specialization as a consequence of bilateral trade flows. Rodriguez-Pose and Gill (2006) distinguish different trade patterns of manufactured and agricultural goods. Their sample consists of four developing and four developed countries over the period 1980 - 2000. They explore how changes of manufactured to agricultural trade flows increase regional disparities (increasing trade in manufacturing goods, agricultural trade unchanged).[76] For six of seven countries the authors exhibit that regional disparities increase as agricultural exports became less important than manufacturing exports. According to this study, regional disparities decreased with increasing manufacturing exports and unchanged agricultural exports.

Another important factor is the degree of financial development. In this context Svaleryd and Vlachos (2002) examine the impact of financial markets and their development on industrial specialization for 27 OECD countries. Their results indicate that financial development among the OECD countries has had greater impact on specialization

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[76] Their study includes the countries: Brazil, China, Germany, India, Italy, Mexico, Spain and USA.

than human or physical capital. According to their results, specialization of trading countries is driven by the financial sector. Hence, industry specific shocks affect the trading countries according to their industrial specialization.

Finally, Imbs (2004) examines whether specialization patterns have had a direct impact on business-cycle co-movements of trading countries. He covers 24 countries over different time periods but mainly 1980 - 2000. The cycles converged with increasing similarity between the countries. Financial integration within a region has boosted the convergence even more.

All these results indicate that the impact of trade, specialization, business cycle-co-movements and financial integration is very sensitive to the chosen country or region. Thus in the present study, three different country groups are examined and two of these country groups are additionally subdivided. Consequently, the estimated hypotheses should reflect the impact of different country groupings. Furthermore, the literature on risk sharing itself does not come to a consentaneous conclusion either, even with considering different characteristics of the respective countries and regions. The missing link for different directions of risk sharing might be industrial specialization within one region or country group respectively. According to the standard trade literature, trade might drive specialization in different industries and inter-industry trade arises as a consequence of specialization. Furthermore, there might be specialization in similar industries within one country group and intra-industry trade is the consequence within this country group. These considerations will be combined with the risk-sharing literature.

There are two strands of literature arguing in favour of two different directions of risk sharing within a region: the first is represented for example by Asdrubali et al. (1996), Crucini (1999) or Bayoumi and Klein (1997). They all conclude that risk sharing is higher for regions within a country than between different countries. This suggests that a country group with synchronized business cycles is supposed to share more risk within the group than members of a country group with diverging business cycles. Athanasoulis and van Wincoop (2001) examine risk sharing behaviour among the states of the USA for the years 1963 - 1990. The authors state that regions of a country share more risk among each other if there are no capital controls or language barriers. Additionally, a common regulatory framework, common accounting standards and a shared currency enhance the risk sharing between these regions. These results are supported by the studies of for example Bayoumi and Klein (1997) and Crucini (1999). Bayoumi and Klein examine the integration process within Canada and between Canada and the rest of the world. The authors analyse the years 1971 - 1992. Bayoumi and Klein state that national borders matter significantly for integration of trade, financial markets and risk sharing. Crucini covers the years 1970 - 1990. His results indicate that during this time, the Canadian provinces and the U. S. states shared more risk among each other than the G-7 countries between each other. Generalising these results may lead to the assumption that, with successive trade and financial liberalization, risk sharing increases between countries. Furthermore, if the countries are endowed with different factors, then the trading countries specialize in different industries and goods, respectively. These countries may then be more vulnerable to idiosyncratic industry shocks. As a result, business cycles of the trading partners become less correlated and risk-sharing

becomes possible between the trading countries. From these considerations, hypothesis 1

can be derived:

Hypothesis 1   *A group of countries with dissimilar factor endowments specialize in the*

production of dissimilar goods. Trade arises between industries and drives specializa-

tion. Business cycles of these countries will diverge and risk-sharing is possible within

the respective country group.

In contrast to these approaches, there are others suggesting that regions within a

country do not share a high amount of risk among each other. Regions within a country

are supposed to exhibit a low degree of risk sharing. Hess and Shin (1998) analyse risk

sharing behaviour of U.S. states. They affirm that the states within the US share less risk

among each other than internationally. Hess and Shin (2000) test USA household data

from 1981 to 1987. They conclude that during this period risk sharing among states and

industries of the USA is rather low. Similarly, van Wincoop (1995) concludes that in the

years 1970 - 1989 there is no difference in risk sharing among the Japanese prefectures and

among the OECD countries. More recently, Kim and Sheen (2006) examine the degree

of risk sharing between Australia and New Zealand. For reasons of comparison, they also

study the risk sharing behaviour between Australia and the USA. Even though the business

cycles are more synchronized between Australia and the USA, the degree of risk sharing

is significantly lower than between Australia and New Zealand. Hence, it is not mandatory

that similar countries share risk. Again, generalising the results for regions of a country

allows for the consideration that countries within a country group specialise in similar

industries. Thus, with proceeding trade integration industries will concentrate and intra-

industry trade arises. This in turn leads to convergence of business cycles between the

trading partners and vulnerability for the same shocks for one country group. Consequently, only a low degree of risk sharing among these countries is possible. Hence, the second hypothesis accounts for the specialization of a country group in similar industries and its consequences:

Hypothesis 2   *Countries within one region specialize in similar industries. The main share of trade is intra-industry and trade does not drive specialization within the country group. Business cycles for this country group tend to converge and risk-sharing cannot take place within the country group.*

It is important to note that the confirmation of the hypotheses might be valid for a region as a whole, but they vary within the region. For example, the European core countries may display different specialization patterns from the peripheral countries or the new accession countries. Therefore, we do not only focus on the three major regions Asia, Europe and Latin America, but we regroup Europe and Latin America into two subgroups: Europe Core, Europe CEEC, Latin America Central, Latin America South.

3.3 Methodology and Data

We construct four equations according to the two hypotheses. These equations reproduce

the simultaneous impact of trade, specialization and business-cycle-correlations.

$$risk_{ij} \; = \; \alpha_0 + \alpha_1 trade_{ij} + \alpha_2 spec_{ij} + \alpha_3 bc_{ij} + a_4 C_1 + \varepsilon_{1,ij} \qquad (3.92)$$

$$trade_{ij} \; = \; \beta_0 + \beta_1 spec_{ij} + \beta_2 C_2 + \varepsilon_{2,ij} \qquad (3.93)$$

$$spec_{ij} \; = \; \gamma_0 + \gamma_1 trade_{ij} + \gamma_2 C_3 + \varepsilon_{3,ij} \qquad (3.94)$$

$$bc_{ij} \; = \; \delta_0 + \delta_1 trade_{ij} + \delta_2 spec\;ij + \delta_3 C_4 + \varepsilon_{4,ij}. \qquad (3.95)$$

To evaluate the simultaneous impact of trade, specialization and business-cycle-correlation

on cross-country risk sharing, we estimate the above equation system. The indices i and j

mark the country and the trading partner respectively. The endogenous variables are risk

sharing $\equiv risk$, bilateral trade intensity $\equiv trade$, bilateral specialization $\equiv spec$ and bi-

lateral movement of business-cycles $\equiv bc$. Each estimation equation contains a vector of

exogenous determinants C_1, C_2, C_3, C_4. These vectors are specific for every endogenous

variable. In order to identify the system differences between these vectors are required.

C_1 includes financial controls. The financial controls take into account the financial depth,

financial activity, size of the stock market and the activity of the stock market of the respec-

tive country and its partner country. We use the most common proxies for these financial

controls: financial depth is indicated by the ratio of liquid liabilities to GDP, the ratio of

credit from any financial institution to GDP is our proxy for financial activity, the size of

the stock market is measured by the stock market capitalization to GDP ratio and the ac-

tivity of the stock market by the total value of the stock market to GDP ratio.[77] C_2 is the
vector for the trade estimation. It controls for the similarity of the two trading countries.
Therefore, distance, GDP, language, religion, ethnic, distance and a dummy for a shared
border are included. C_3 consists of proxies for differences in growth and financial debts
of the two trading countries. C_4 depicts differences in financial growth of a country pair
and also includes industrial dummies. We control in every estimation for time and country
effects.

Risk sharing is the dependent variable in equation (3.92). In view of the proceed-
ing economic integration, it has gained particularly importance. Increased risk sharing
can reduce vulnerability of countries and industries from shocks in neighbouring countries
and regions. Additionally, risk sharing via credit and financial markets can substitute for
missing governmental adjustment mechanisms.[78] Trade is directly included as estimator in
this equation because trade might work as a transmission channel for productivity shocks
between trading partners. The expected effect of trade on risk sharing depends on the un-
derlying theory: hypothesis 1 suggests a negative or insignificant impact of trade on risk
sharing, $\alpha_1$would be negative. Trade transfers shocks only between different industries and
in this case not to the trading partner's industry. Thus, increasing trade does not increase
vulnerability of the trading partner's economy. With regard to hypothesis 2, the sign of α_1
is expected to be positive as with increasing trade between countries their dependence on

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[77]   For a detailed discussion of these financial measures, see Beck et al. (1999).

[78]   See for example Labhard and Sawicke (2006), Asdrubali, Sorensen and Yosha (1996), Athanasoulis
and van Wincoop (2001). They all show the importance of risk sharing and the increasing vulnerability to
shocks through increasing economic integration. Furthermore, the relevance of different risk sharing channels
changes and hence they can only partly substitute for each other. This is an important fact to be considered
for fiscal policy settings.

each other's economies increases and so does their need for risk sharing. Equation (3.93) measures whether trade is driven by specialization or not. Specialization, $spec$, is a estimator in the trade equation and $Spec$ is high for countries with very different specialization patterns. A negative β_1 indicates that trade increases with a decreasing level of dissimilarity. Trading partners with related industrial characteristics combine a positive α_1 with a negative β_1. Even though shocks are transferred more easily from one country to another country through increased trade, due to similar industry structure between the countries, risk sharing is reduced. In contrast, trading partners with dissimilar industries combine a negative α_1 with a positive β_1. Shock transmission is hindered by increasing inter-industry trade and additional risk sharing is possible through the varying specialization patterns between the trading partners. Moreover, β_2 impacts risk sharing via $trade_{ij}$. In C_2 various gravity variables and home and foreign gdp data are included. Thus, the complete effect of trade on risk sharing consists of $\alpha_1\beta_1 + \alpha_1\beta_2$.

The second estimator in the risk sharing equation (3.92) is specialization. The direct impact of specialization on risk sharing is expected to be positive. Higher specialization is accompanied by increasing possibilities to share country and industry specific risk. However, there are also two indirect effects to consider. The first factor is trade. In dependence of the underlying theory, trade can boost specialization in various directions between trading partners as well as drive specialization in similar industries. Consequently, with hypothesis 1, the effect of $\alpha_2\gamma_1$ is supposed to be positive. A negative effect of $\alpha_2\gamma_1$ is expected with hypothesis 2. C_3 includes specific variables for specialization like differences

in the development of financial markets and in country size of the trading partners. The entire impact of specialization is $\alpha_2\gamma_1 + \alpha_2\gamma_2$.

Business-cycle co-movement is the third estimator for risk-sharing in equation (3.92). The isolated direct effect of business cycle co-movement α_3 is expected to be negative. Convergence of business cycles hinders risk sharing between the respective countries. The entire impact on risk sharing consists of three components: $\alpha_3\delta_1 + \alpha_3\delta_2 + \alpha_3\delta_3$. Trade can impact business cycle co-movements in either direction. According to hypothesis 1, the assumed influence of trade is negative as with increasing trade business cycles diverge. Reversely, with hypothesis 2 business cycles between countries converge with increasing trade. The sign of δ_1 depends on the underlying hypothesis. Specialization always drives co-movements. However, δ_2 is not unambiguously signed. Increasing specialization in varying industries leads to diverging and synchronous specialization to converging business-cycles between countries. Finally, there are industry and country specific variables included in C_4.

The last estimator α_4 in the risk sharing equation (3.92) encompasses in C_1 financial variables to control for differences in financial development. These include proxy variables for the size and activity of the stock market and measures for financial development, financial depth and activity of financial intermediaries of a country and of his trading partner.

The discussion of the estimators clarifies the simultaneous influence of trade, specialization and business cycles. To allow for this two-way endogeneity, we apply a simultaneous estimation method analogue to Imbs (2004). Three-stage least squares estimates the system in three steps and considers the endogeneity between the dependent variables

of equation (3.93) - (3.95): trade, specialization and business cycle co-movements. In the first step, instrumented values for all endogenous variables are developed. In a second step, the covariance matrix of the estimation disturbances is estimated. Finally, in the third step by using this covariance matrix a GLS estimation of (3.92) is implemented. Here, the instrumented values are placed instead of the right-hand-side endogenous variables.[79]

The analysis includes 60 countries from Asia, Europe and Latin America from 1980 to 2005.[80] To account for different stages of integration within a country group, we split the European and the Latin American countries in two different country groups: for Europe, CEEC and Core, and for Latin America, Central and South. Hence, the results can be categorized in differences between the three continents Asia, Europe and Latin America, and regional differences within continents Europe Core and CEEC and Latin America Central and South. Within every continental country group, we arrange country pairs for each country with each other country. The results will be presented by comparing all country groups: Asia, Europe CEEC, Europe Core, Latin America Central and Latin America South.

Imbs (2004) constructs a measure of risk sharing for country-pairs using the data from Lane and Milesi-Ferretti (2001). This measure depends on the net foreign asset positions of the country-pairs. He argues that countries with different external positions are more likely to share risk with each other than countries with similar net foreign asset positions. Analogue to this measure, we use data from the World Bank World Development Indicators

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[79]   For a detailed discussion of simultaneous estimation, see Wooldridge (2002) and 3SLS Zellner and Theil (1962).

[80]   A list of the included countries can be found in 3.7 Appendix.

(WDI) to create a similar index for financial risk sharing between country pairs in the period

1980 - 2005[81]

$$risk^1_{ij} = \left| \frac{nfa_i}{gdp_i} - \frac{nfa_j}{gdp_j} \right|.$$

The measure indicates the difference of the countries net foreign asset position (nfa) as

a share of the respective country GDP. According to Imbs (2004), $risk^1_{ij}$ will be higher

the more diverse the net foreign positions of a country-pair are. It will be low for countries

with similar positions. This indicates that these countries do not tend to borrow or lend very

much from each other. As a second measure of risk sharing, we use the consumption corre-

lation between the country pairs. Generally, consumption correlation tends to synchronize

for countries that pool their risks. These countries are not restricted to their domestic output

and cross-country consumption correlation is higher. The development and activity of the

financial markets also play a major role for risk sharing between two countries. Thus, the

extent of risk sharing and the corresponding consumption correlation depend on the cho-

sen country group and their bilateral financial integration. This justifies the diverse country

groupings between the continents and within a continent. There is no definite consensus

about the effects of risk sharing on the dimension of consumption correlation. Particularly,

the impact of financial market integration on consumption correlation is twofold.

Feeney and Jones (1994) suggest a differentiated view on consumption. Agents re-

spond differently to aggregate consumption risk or composite consumption risk. The model

of Pakko (1997) suggests that, even with complete asset markets, a low cross-country con-

sumption correlation is possible. This contradicts the findings of Baxter and Crucini (1995).

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[81]   For sensitivity analysis, we also generate this measure using data from the Penn World Tables 6.2.

They suggest that asset market incompleteness accounts for low cross-country consumption correlation. Restrained risk-sharing opportunities tie consumption more closely to domestic output than to world output and hence the cross-country correlation is lower. In line with these findings Heathcote and Perry (2003) conclude for the US that financial integration can have two different impacts on consumption correlation. First, increasing financial integration boosts cross-country consumption correlation because agents use financial markets to smooth their total consumption over time. Second, financial integration decreases consumption correlation between countries because consumers use financial markets to reduce deviations in their bundle from the optimal composition of home and foreign goods. Hence, consumption correlation as a measure of risk sharing between different country groupings can be used as confirmation of the financial risk sharing measure. Additionally, it is important to control for financial integration and development as well. This is done by the equation specific control variables $C_1 - C_4$. The consumption data is obtained from the World Bank's World Development Indicator Data Base (WDI).

We use total trade data from the IMF database total direction of trade and 1 digit industry trade data from the UN Comtrade database. Both datasets include the 60 countries from 1980 to 2005. To measure trade intensity, we use a standard measure for trade intensity according to Frankel and Rose (1998). The first trade measure relates bilateral trade flows to the total international trade activity of the respective countries:

$$trade^1 = \frac{1}{T}\sum_{t=1}^{T}\frac{x_{ijt} + m_{ijt}}{x_{i.t} + x_{j.t} + m_{i.t} + m_{j.t}}. \tag{3.96}$$

x_{ijt} denotes the total export of country i to country j at time t. Imports between the countries at the time t are defined by m_{ijt}. The higher $trade^1$, the higher is the trade intensity

between the countries i and j. The second measure relates trade activity between the trading partners to their GDP. Trade intensity is connected to country size

$$trade^2 = \frac{1}{T}\sum_{t=1}^{T}\frac{x_{ijt} + m_{ijt}}{gdp_{i.t} + gdp_{j.t}}.\qquad(3.97)$$

This measure shows the share of trade between the countries divided by their total output. For all countries the GDP data is taken from the Penn World Tables and for a sensitivity check we use data from the Worldbank World Development Indicators.

We use a third measure of trade intensity analogue to the one used by Deardorff (1998). In contrast to the index in (3.97) the trade activities of this third measure are weighted with world GDP.[82]

$$trade^3 = 0,5\frac{1}{T}\sum_{t=1}^{T}\frac{(x_{ijt} + m_{ijt})\,gdp_{wt}}{gdp_{i.t} \times gdp_{j.t}}.\qquad(3.98)$$

Size effects are eliminated and trade intensity only depends on trade barriers. In particular, this third trade measure (3.98) takes the value 1 if there are no trade barriers and preferences are homothetic.[83]

Specialization is measured by two different indices. However, the measure from Imbs (2003) is the basis for both indices

$$spec_{ij} = \frac{1}{T}\sum_{t=1}^{T}\sum_{k=1}^{K}|s_{ki} - s_{kj}|,\qquad(3.99)$$

where s_{ki} is the share of industry k in country i. This share is measured by industry output relative to total country GDP or industry value added relative to total country GDP. Industry data is obtained from the Unido Industrial Database. According to (3.99), the more

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[82]   This measure is constructed with the WDI data only.

[83]   See Deardorff (1998) for a derivation of these results.

countries specialize in simultaneous industries, the lower is $spec_{ij}$. Country pairs with no similar specialization display a high $spec_{ij}$.

Business cycle co-movements are measured by cross-country correlation of GDP. The data for the macroeconomic variable is taken from the WDI database. In order to isolate the cyclical component of the data, we use the Christiano Fitzgerald Random Walk Band Pass filter described in Christiano and Fitzgerald (2003). This filter is a generalization of the Baxter King Band Pass Fitler.

The data for the financial control variables in equation (3.92) are taken from the WDI database. Additional gravity data in equation (3.93) is obtained from the CIA World Factbook. Distances between capital cities are provided by John Byers' Website "Chemical Ecology of Insects".

3.4   Results

3.4.1   Estimations with Total Trade Data

Financial Risk Sharing

Table (3.12) contains the results of the simultaneous estimation of equation (3.92) with the total trade data.[84] Financial risk-sharing is explained by trade, specialization and business cycle behaviour. The results indicate a significant negative impact of trade on financial risk sharing only for the European CEEC and the central Latin American countries.[85]

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[84]   In Table (3.12) data is total trade data. Risk sharing is measured by net foreign asset positions.

[85]   The gravity variables in Table (3.18) in 3.7 Appendix show the expected signs. Only for the European

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
Trade	-0.2226	-0.2660***	-0.0082	-0.0321***	-0.2227
	(-1.33)	(-5.90)	(-1.57)	(-4.05)	(-0.46)
Spec	0.0181	-0.1381***	0.0008***	-0.0029	-0.2182
	(1.34)	(-7.59)	(5.45)	(-1.59)	(-1.25)
BC	0.3285	0.0073***	0.0012*	0.0017*	-0.2415**
	(1.70)	(6.81)	(2.48)	(2.27)	(-3.01)
N	2040	1070	202	134	1030
R^2	0.41	-0.78	-1.31	0.55	-0.56

t statistics in parentheses

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.12. Direct Impact on Risk Diversification separated by Country Groups

Hence, trade is not necessarily a channel for productivity shocks which turn into bilateral financial risk sharing between the trading countries. Even though trade might increase a country's vulnerability to its neighbours shocks, these shocks may not be dampened by financial risk sharing between these countries or the respective country group. For the CEEC and the Central Latin American countries, bilateral financial risk sharing actually decreases with higher bilateral trade. For these country groups, trade transfers additional shocks from one country to another but this additional risk is not dampened within the group. The significant negative trade impact on risk sharing might be interpreted as a stronger risk sharing of the countries within the group with countries outside the respective country group.

Regarding specialization, the results exhibit a significant impact on risk sharing within a country group only for the European countries. Interestingly, the direction of the impact differs for CEEC compared to the European Core countries. For the European Core countries, the results suggest that with higher specialization in different industries the countries

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CEEC and the Central American countries distance is positive but not significant.

increase their financial risk sharing among each other. They exploit the various shock vulnerability to dampen possible shocks on their respective main industry. In contrast, for the CEEC countries risk sharing decreases with higher specialization. Analogue to the significant negative trade impact on financial risk sharing, this effect might be caused by stronger linkages to countries outside than within the CEEC-group. The insignificant influence of distance on bilateral trade for the CEEC supports the assumption of a less regional linkage of these countries, and stronger relations to countries outside this country group.[86] The same holds for the Central American countries. The results also exhibit a negative impact of bilateral trade on risk sharing. The European CEEC countries as well as the Central American countries display no significant impact of distance on bilateral trade within their country group. This supports the assumption that external relations are stronger than the linkages within the respective country group. This also impacts the effect of specialization on risk sharing: with increasing specialization, these countries decrease their "regional" risk sharing and might increase their international links.

Surprisingly, business cycle correlations affect risk sharing positively in every country group except Asia, where the coefficient is not significant, and the southern Latin American countries, where the coefficient is significantly negative. However, the impact for the European Core countries is rather low. This supports the results from specialization and bilateral trade. On the other hand, the CEEC show a higher impact of business cycle correlations on financial risk sharing. Again, this suggests that the more similar these countries are, the more risk they share between each other. This supports the decreasing risk sharing

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[86]   Results of the trade control variables are presented in Table 3.18 in the 3.7 Appendix.

as a consequence of increasing specialization. The insignificant coefficient of business cycle co-movements for the Asian countries is in line with the results of Kim et al. (2006). The authors conclude that the Asian countries do not use financial channels as main risk sharing instrument to smooth cross-country variances of the GDP. Kim and Sheen (2007) study the risk sharing behaviour between Australia and New Zealand. Their results indicate that Australia and New Zealand mainly use credit markets to smooth their income shocks between each other. As in the current analysis, the East Asian Countries are grouped with Australia and New Zealand, the insignificant impact of business cycle co-movements is not surprising. The significance of business cycle correlations for the European core countries is also in line with the existing literature. The results of Sorensen and Yosha (1998) suggest that until 1990 borrowing and lending between the European countries was not the main channel to smooth risk between them. These results hold also for the OECD countries. The previous intuition that a country group will pool its risk within the country only if the countries are dissimilar seems not definitely supported. The disaggregation of the total impact might help to clarify some of these effects.

These results might support the second strand of risk sharing literature by indicating that diverging business cycles between the members of a country group open additional opportunities for risk sharing within the respective group.

To disentangle the above effects, we turn to the analysis of the direct and indirect channels through which risk sharing is affected by the three main variables: trade, special-

ization and business cycle co-movements. Table (3.13) presents the results from equations

(3.93) - (3.95).[87]

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[87] In Table (3.13) data is total trade data. Risk sharing is measured by net foreign asset positions.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
Trade					
Spec	-0.0004***	-0.0001	-0.0013***	-0.0150***	0.0041***
	(-18.96)	(-0.04)	(-5.15)	(-3.69)	(9.55)
GDP_i	0.0265	-0.0178	0.4210***	-0.5900**	0.0785***
	(1.88)	(-0.56)	(3.96)	(-2.64)	(5.83)
GDP_j	-0.0154***	-0.0261***	-0.2130**	-0.5760**	0.1420***
	(-3.57)	(-3.71)	(-2.66)	(-2.95)	(10.49)
Spec					
Trade	-0.5329***	-0.0073*	-0.1408***	-0.0258***	0.0304***
	(-9.32)	(-2.28)	(-3.41)	(-6.94)	(3.88)
Size	-0.0049**	0.0001*	-0.0003	0.0001	0.0001
	(-3.20)	(2.27)	(-0.18)	(0.21)	(0.50)
Finance	-0.0005**	0.0001	-0.0022*	-0.0001	0.0001
	(-3.25)	(1.85)	(-2.42)	(-0.64)	(1.44)
BC					
Trade	0.0271***	0.2139***	0.0493***	-0.0141	0.0005
	(6.62)	(10.32)	(5.81)	(-1.29)	(0.09)
Spec	-0.0034***	0.5020***	-0.0026	-0.0435	-0.0671***
	(-11.94)	(7.73)	(-0.99)	(-1.65)	(-11.16)
Finance	-0.0415***	-0.1880***	-0.7500***	-0.0156	0.0521
	(-3.84)	(-5.89)	(-3.92)	(-0.18)	(1.64)
N	2040	1070	202	134	1030
R^2 Trade	0.01	0.35	0.41	0.47	-0.09
R^2 Spec	0.23	0.11	0.17	0.18	0.01
R^2 BC	0.26	-0.44	0.30	-0.01	-1.28

t statistics in parentheses
$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.13. Indirect Impact on Risk Diversification separated by Country Groups

The total trade impact on risk sharing can be decomposed in two direct effects: intra-industry $(\alpha_1\beta_1)$ and geographical $(\alpha_1\beta_2)$ trade. There are also two indirect channels, through which trade affects risk sharing, namely through specialization $(\alpha_2\gamma_1)$ and business cycle co-movements $(\alpha_3\delta_1)$.

In comparison to the other country groups, for Asia the negative impact of trade on risk sharing is driven by a high share of intra-industry trade, as the results for Asia indicate that specialization impacts trade significantly negatively. A high share of the trade impact on risk sharing can be attributed to trade between countries with similar specialization patterns. This increases the vulnerability to similar shocks within the country group and thus the need for risk sharing. However, the opportunities of risk sharing decrease within this group. This is reflected by the negative sign of the indirect channel of the trade impact via specialization. Yet, these results for the Asian country group should be interpreted with caution, as the explanatory power for trade is very weak within this country group.

In contrast to the Asian countries, the trade coefficient in (3.93) for the European CEEC countries suggests no significant impact of intra-industry trade. Additionally, the geographical trade variables indicate a rather weak trade and risk sharing link between the CEEC countries. As a consequence, increasing bilateral trade does not boost financial risk sharing between the CEEC countries. Intra-industry trade seems not to be a major link between the European core countries either. Yet, according to Table (3.18) in the Appendix, within this country group the coefficients of the geographical variables are significantly positive (except the distance variable). Hence, trade appears to arise between close coun-

tries and similar countries. Even though the trade link within this country group is strong, the impact on risk sharing is not significant.

Similar to the Asian countries, Central America indicates a high impact of intra-industry trade on risk sharing in comparison to the rest of the country groups. Intra-industry trade appears to enhance the sensitivity within the Central American country group for similar industry shocks thus raising the need for risk sharing. The geographical trade variables indicate a weak "regional" link for Central America. Hence, increasing bilateral trade does not seem to increase the possibilities for bilateral risk sharing within this country group. The only countries with a negative impact of intra-industry trade on risk sharing are the Latin American southern countries. Within these countries, trade appears to transfer barely similar productivity shocks. Furthermore, the coefficients of the geographical variables display a weak link between these countries. Thus, the need for risk sharing does not seem to increase very much through bilateral trade. The weak regional connection implies low risk sharing within the group.

One further effect should be noted: all country groups- expect the southern Latin American countries - show negative trade impact on specialization and vice versa. Intra-industry trade is definitely present within these respective country groups and only the degree varies and so does its impact on intra-group risk sharing. Unlike the direct trade or specialization impact, these indirect channels are all significant. South Latin America is the only country group that has no obvious appearance of intra-industry trade at all.

The control variables for the financial activity, depth and development have the strongest impact on risk sharing for Asia.[88] For Latin America south, none of the respective coefficients is significant for the risk sharing activity within this group. Again, this supports the weak linkage within and a stronger connection outside this country grouping. The European CEEC group shows higher sensitivity to the financial development and activity of the partner country than to its own financial market. For the European core countries, as well as the Central Latin America countries the development of their own financial market and the financial status of the partner country indicate similar impact on risk-sharing within the respective country group. Generally, the significance of the financial variables for both groups is low.

Overall, the results indicate that intra-industry trade is very dominant among the analysed country groups. This result is supported by the estimation results of equation (3.93) - (3.95). Business cycle co-movements significantly converge with trade except for the Latin American countries. Yet, no clear-cut picture emerges for the effects of specialization on business cycle co-movements. For the Asian and southern Latin American countries specialization is supposed to lead to diverging business cycles and for the CEEC to converging business cycles. For the two remaining country groups, the European Core and Latin American central countries, no significant impact of specialization on business cycle co-movements is found. Consequently, the ambiguous influence of business cycle co-movements on financial risk-sharing is likely to be caused by diverse indirect effects that vary between the country groups.

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[88]   Table (3.19) in 3.7 Appendix presents these results.

The results for financial risk sharing are not always as expected. Yet, the measure of risk sharing used in this estimation is just one possible channel of financial risk sharing, namely for risk sharing via credit markets. Even though the importance of this channel increased in the various regions, it is ambiguous. In order to check the robustness of the results, the analysis is repeated for consumption risk sharing within the various country groups.

Consumption Risk Sharing

According to different approaches in the literature, for example Crucini (1999), consumption is supposed to converge for regions that pool their risk. Following from this, consumption correlation is used as a proxy variable for risk sharing. This general assumption can be split in two parts. Risk sharing via financial markets reduces variations in the total consumption over time. Hence, risk sharing or financial integration should increase consumption correlation within a country group. The countereffect is that financial risk sharing reduces deviations from the optimal consumption composition. As a consequence, consumption correlation within a country group diverges with increasing risk sharing. Table (3.14) contains the respective estimation results of equation (3.92) - (3.95)with consumption correlation as proxy for risk sharing.[89]

There are three obvious differences compared to the estimation results of financial risk sharing: trade has a significant and positive impact on consumption correlation for the Asian, European core and southern Latin America countries. The significant negative trade

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[89]   In Table (3.14), data is total trade data. Risk sharing is measured by consumption correlation.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
Trade	0.0668***	-0.0876**	0.1329***	-0.0081	0.0776***
	(10.59)	(-3.09)	(7.26)	(-1.11)	(8.48)
Spec	0.0059***	-0.6000***	0.0075	-0.0386*	-0.0082
	(11.95)	(-4.67)	(1.40)	(-2.28)	(-0.31)
BC	0.0392***	0.0334***	-0.0092	0.0210**	0.130***
	(5.55)	(3.99)	(-0.53)	(3.15)	(9.50)
N	2040	1070	202	134	1030
R^2	0.01	-0.19	0.43	0.55	-0.56

t statistics in parentheses

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.14. Direct Impact on Risk Diversification separated by Country Groups

effect for the European CEEC is confirmed, whereas for the central Latin America the coefficient drops to insignificant. In view of the previous findings, the change of the trade coefficient with respect to the significance level and its magnitude does not surprise: according to the first estimation, the Latin America southern grouping is the country group with the lowest, rather non existent, intra-industry trade link. Hence, increasing consumption correlation induced by rising bilateral trade confirms this result. If trade is not intra-industry then the main trading goods are consumption goods of the respective industries in the trading countries. Consequently, the trading countries assimilate their consumption behaviour by exchanging the available goods. The change of the trade impact for the European core group can be partially referred to a similar trading behaviour as for the southern American countries. The amount of intra-industry trade on total trade of the European core group is not very high in the first estimation for financial risk sharing. Hence, a reasonable part of bilateral trade within this country group consists of final goods. In turn, increasing trade of consumption goods of differing industries in the respective countries enhances the con-

vergence of consumption between these countries. Even though the financial risk-sharing estimation indicates a higher amount of intra-industry trade for the Asian countries, the now positive trade impact might be based on similar arguments. More precisely, the positive impact of trade on consumption correlation is positive and highly significant, but at a very low level. In general, with increasing trade the respective countries are not tied to their domestic production anymore, and the composition of their consumption bundles synchronize among their trading partners.

In comparison to financial risk sharing, the effect of specialization on consumption risk sharing never changes its sign. The effect of specialization on risk sharing between the European core countries drops to insignificant. Within the European CEEC grouping, the impact of specialization does not change at all. Business cycle co-movements is now positive for Asia, Europe CEEC and Central Latin America. The impact of business cycle co-movements changes its sign for the European core and the southern Latin American group. For the former, the negative effect is not significant, whereas for the latter, business cycle co-movements affect consumption correlation significantly positively. The positive relation between business cycle co-movements and consumption correlation for countries within one group is not surprising at all. With increasing correlation of their business cycles these countries have the possibility to synchronize the composition of their consumption bundle. The business cycle co-movements are partly driven by increasing trade between the respective countries. The only significant exception for this explanation is again the southern Latin American country group. Their trade share in the business cycle co-movement is negative and significant. Hence, there is need for another explanation of the positive impact

of business cycle co-movements and consumption correlation. A further explanation for a positive impact of business cycle co-movements and consumption correlation might be the income correlation. With increasing business cycle convergence the income in the country group converges as well. This in turn is a strong driver for consumption convergence within this group.[90]

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[90]   Crucini (1999) shows very clearly how cross-regional consumption correlation follows cross-regional income growth correlation for the USA, the Canadian Provinces and the OECD countries.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
Trade					
Spec	-0.0044***	0.0000	-0.0141***	-0.1250**	0.0443***
	(-19.10)	(0.00)	(-5.44)	(-3.11)	(10.00)
GDP$_i$	0.0281*	-0.0117	0.446***	-0.736***	0.107***
	(1.99)	(-0.36)	(4.26)	(-3.35)	(8.92)
GDP$_j$	-0.0157***	-0.0263***	-0.256**	-0.692***	0.161***
	(-3.65)	(-3.65)	(-3.23)	(-3.61)	(12.73)
Spec					
Trade	-0.5284***	-0.0076*	-0.1422***	-0.0257***	0.0311***
	(-9.25)	(-2.36)	(-3.43)	(-6.90)	(4.00)
Size	-0.0042**	0.0001	0.0002	0.0001	0.0001
	(-2.80)	(1.94)	(0.11)	(0.24)	(0.46)
Finance	-0.0005**	0.0000	-0.0021*	-0.0000	0.0001
	(-3.23)	(1.82)	(-2.31)	(-0.76)	(1.32)
BC					
Trade	0.0271***	0.2041***	0.0491***	-0.0146	0.0002
	(6.62)	(10.24)	(5.80)	(-1.34)	(0.04)
Spec	-0.0034***	0.406***	-0.0032	-0.058*	-0.07***
	(-11.97)	(6.32)	(-1.23)	(-2.20)	(-11.31)
Finance	-0.0416***	-0.192***	-0.769***	-0.0056	0.0498
	(-3.85)	(-6.04)	(-4.02)	(-0.07)	(1.57)
N	2040	1070	202	134	1030
R^2					
Trade	-0.01	0.35	0.39	0.47	-0.09
Spec	0.22	0.11	0.17	0.18	0.01
BC	0.26	-0.26	0.29	-0.01	-1.28

t statistics in parentheses
$^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Table 3.15. Indirect Impact on Risk Diversification separated by Country Groups

Table (3.15) presents the results of decomposition effects for consumption risk shar-ing.[91] The results of the decomposition of the effects derive from the former estimation mainly in three aspects: in the European CEEC grouping, specialization as driving force of trade changes from negative insignificant for the financial risk sharing estimation to positive insignificant for consumption risk sharing. The second change is visible for the European core countries. Market size differences are now positive insignificant and were negative insignificant as explanation for specialization. However, both are minor changes and al-most negligible. The third change is more severe than the previous two. The trade impact on business cycle co-movement is no longer insignificant but negative and highly signifi-cant. Based on the almost non visible share of intra-industry trade, this change might just reflect inter-industry trade with final consumption goods. Therefore, the results indicate that increasing trade leads to divergence of business cycles in the southern Latin American group.

Financial integration can increase as well as decrease consumption correlation be-tween two countries. The composition of the consumption bundles and the consumption path are sensitive to the conditions of the financial markets. In dependence of the domi-nating consumption target, financial integration boosts or reduces consumption correlation. Therefore, we turn to the impact of the financial framework of the home and the partner country. The results for the financial control variables are presented in 3.7 Appendix Table (3.21).

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[91] In Table (3.15) data is total trade data. Risk sharing is measured by consumption correlation.

Most obviously is the change for the Latin American countries. Both groupings react more sensitively to the financial conditions. In particular, the results indicate that the size and activity of the stock market and the degree of financial development of the home as well as of the partner country are important factors for the consumption correlation within both groups. However, the respective direction of the impact is not always identical for both groupings. The Asian country group now reacts relatively stronger to the financial status of the partner country. Furthermore, the own financial framework loses impact in the Asian group. In contrast to the financial risk sharing, the financial controls lose their total impact for the European CEEC countries. No significant effect is found for these countries with respect to consumption correlation. The European core countries shift their sensitivity towards the financial framework of the partner country. The stock market activities especially of the partner country impact the bilateral consumption correlation highly negatively. Overall, the results do not provide a clear-cut picture and the role of the financial markets is not obvious, neither for the financial risk sharing nor the consumption risk sharing estimation. Only a slight tendency in importance towards the Asian and Latin American countries is perceptible. The results lead to the assumption that the importance of financial markets may increase with risk sharing, not within but between the various country groups.

3.4.2   Estimations with Industry Trade Data

Financial Risk Sharing

To analyse whether the effects are different for different industries, the estimation of equations (3.92) - (3.95) is repeated with disaggregated industry trade data.[92] To estimate equations (3.92) - (3.95) with disaggregated industry trade data for the European and Latin American countries requires some changes to the country groups. The two European groups are merged together because of lacking data for the CEEC. Consequently, some European countries are dropped. Furthermore, the time period is shortened to the years 1999 - 2004 because of the data availability.[93] The same pooling procedure is applied to the two Latin American country groups.[94] The pooling of the two European and the two Latin American data might dilute the estimation results.

The direct estimation results deviate slightly from the previous results. Table (3.16), column 1 shows the results for Asia, industry 0, "Food and Live Animals".[95] The coefficients of the direct variables on risk sharing for the Asian countries have the same signs as the coefficients of the estimation utilizing the total direction trade data. Yet, the coefficients of trade and business cycles now turn out to be highly significant. With respect to the in-

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[92]   We use data from five industries separately: S3-7 Machines,Transport Equip; S3-6 Manufactured Goods, S3-5 Chemicals, Reltd. Prod.Nes; S3-3 Fuels, Lubricants, Etc. and S3-0 FOOD and Live Animals. In the text the results are exemplarily shown for the S3-0 group only. We discuss if the results differ between the industries.

[93]   Malta, Bulgaria, Cyprus, Estonia, Latvia, Lithuania, Portugal, Romania, Slovak Republic, Slovenia and Czech Republic are the dropped countries for the estimation with 1dig industry trade data.

[94]   The Bahamas, Bolivia, Chile, Ecuador, El Salvador, Honduras, Panama, Uruguay are dropped from the Latin American country group.

[95]   In Table (3.16) data is disaggregated industry trade data. Risk sharing is measured by net foreign asset positions.

direct effects, the results indicate that specialization is now a main drive for trade between the Asian countries. Hence, with diverging specialization this might reflect an increase of "Food and Live Animals"-trade. This specific intra-industry trade is a rather small part of the general trade impact on risk sharing, since trade consists mainly of inter-industry trade of final goods. The transferred shocks through trade do not affect each country to the same extent. Consequently, the need of risk sharing is not enforced by trade. The coefficients of the geographic variables exhibit the expected sign and indicate existing bilateral trade flows of these industry-products within the Asian group. This confirms the low intra-industry trade share. Not surprisingly, industry trade is a strong driver for specialization between these Asian countries. For these countries, the relation between trade and specialization - and vice versa - is the same for each analysed industry. Also, the estimation results of (3.95) remain almost the same. All the coefficients are robust across the various analysed industries.

The 1dig "Food and Live Animals" results of the European countries differ substantially from the total trade estimation. The second column of Table (3.16) presents the results for the industry estimation. The coefficient of the trade impact is insignificant. With respect to the total trade estimation, the effect of the trade impact on financial risk sharing is insignificant for Europe Core but significantly negative for Europe CEEC. Firstly, after the aggregation of the two European groups, the effect of disaggregated industry trade on financial risk sharing turns out to be insignificant. Secondly, the missing data for many of the CEEC decreases the significance of the trade impact. The indirect impact of specialization through trade is significantly positive. Thus, the inter-industry trade increases the

financial risk sharing within the European country group. However, the direct specialization impact on financial risk sharing is negative. This is consistent with the specialization impact of the CEEC, but contradicts the specialization impact of the core countries in the total trade estimation. The effect stays the same for each separate industry estimate. This might indicate a weak regional link between the countries.

	Asia	Europe	Latin America
Risk			
Trade	-0.1093***	0.0017	0.0716
	(-4.34)	(1.27)	(1.83)
Spec	0.0020	-0.0021**	0.0053
	(1.83)	(-2.73)	(1.31)
BC	0.174***	-0.0000	0.0007
	(7.40)	(-0.02)	(0.13)
Trade			
Spec	0.0965***	0.264***	0.0425***
	(15.36)	(7.57)	(6.50)
GDP_i	0.1339	0.1677***	0.2207***
	(0.17)	(5.52)	(5.20)
GDP_j	0.0074	0.1048***	0.2454***
	(0.06)	(3.64)	(5.71)
Spec			
Trade	0.6511***	0.1255**	-0.0713
	(5.77)	(3.10)	(-1.00)
Size	-0.327	-0.0125	0.0012
	(-1.14)	(-0.56)	(0.03)
Finance	-0.0992**	-0.0010	-0.0026
	(-2.88)	(-0.65)	(-0.34)
BC			
Trade	0.0241***	0.144***	0.104*
	(5.66)	(3.63)	(2.40)
Spec	-0.0002***	-0.0086***	-0.0015**
	(-5.85)	(-4.32)	(-2.71)
Finance	0.0022***	-0.0001	0.0001
	(14.84)	(-0.59)	(0.11)
N	711	631	731
R^2 Risk	0.36	-1.1653	0.10
R^2 Trade	-3.44	-0.68	0.19
R^2 Spec	0.29	0.01	0.01
R^2 BC	0.11	-2.13	-0.03

t statistics in parentheses
$*p < 0.05$, $**p < 0.01$, $***p < 0.001$

Table 3.16. Direct and Indirect Impact on Risk Diversification separated by Country Groups

However, the impact turns positive if the number of industries in the analysis is enlarged. Thus, the weak regional link is not caused by a weak European link generally, but by a weak link between the respective industries. The business cycle co-movements show the expected impact on risk sharing. With diverging business cycles, the risk sharing between the European countries increases. The significance of this impact increases with the

number of industries in the analysis. In contrast to the total trade estimation, dissimilar countries are included in the European group. Thus, risk sharing in dependence of diverging business cycles is more likely to occur. The change of the business cycle impact is even more accounted for by the new country grouping, as the indirect effects of business cycle co-movements stay almost unchanged. Only specialization affects the co-movements now differently than in the total trade estimation. The negative specialization impact differs from the CEEC effect with total trade data with respect to the sign and from the core countries with respect to the significance. However, with total trade the CEEC specialization impact is positive and highly significant; it is the exception of the specialization impacts of all country groupings. Therefore, the transformation into a negative significant impact for the whole European group is not surprising but rather intuitive. None of the impacts varies by the different industry estimates. Only industry three "Fuels, Lubricants, etc" has some changes in signs, but just for insignificant impacts.

The Latin America countries now show no significant direct impact on risk sharing at all. The estimation results for the 1dig "Food and Live Animals" industry are shown in column 3 of Table (3.16). Analogue to the European countries, the aggregation of both Latin American country groups dilute the results. This is valid for all tested industries. The indirect channels are also very weak. Particularly specialization seems to be unaffected by any link between the Latin American countries. Trade, on the other hand depends significantly on specialization patterns within the group as well as on the geographic variables. Only distance loses its significance. Again, this supports the missing linkages between the Latin American countries. The influences on business cycle co-movements depend on the

industry. Specialization drives the divergence of diverging business cycles significantly for "Food and Live Animals", "Beverages and Tobacco", "Crude Materials" and "Fuels, Lubricants, etc". For "Chemicals, relatd. Prod. NES", "Manufactured Goods" and "Machines, Transport Equip." specialization still impacts business cycle co-movements negatively. The influence is not significant anymore. However, trade drives business cycle convergences significantly for all industries but "Beverages and Tobacco".

Overall, the diverse impact of trade and specialization on business cycles indicate that business cycles diverge by proceeding specialization and converge with increasing trade integration. This supports the results of Frankel and Rose (1998) who state that demand shocks and intra-industry trade cause business cycles to converge. Additionally, further results show that the impact of specialization on trade is always significant, whereas trade does not affect specialization in all cases. The trade impact on specialization turns significant if the number of specialization possibilities is extended. These findings confirm Fidrmuc (2004). He stated that not only trade intensity but also trade composition affect business cycles behaviour.

Trade and specialization drive bilateral consumption correlation for all country groups. Hence, trade integration uncouples consumption from domestic production and increases the share of foreign goods in the consumption composition. The positive impact of specialization on consumption correlation emphasizes this effect additionally. However, a significant trade impact is present only for the Latin American countries and specialization is significant for Asia and Latin America. Again, the results stay the same for each tested industries. The direct impacts change with the number of industries. Analogue to the fi-

nancial risk sharing estimation the composition of trade and specialization is the crucial factor.

Consumption Risk Sharing

The results for consumption risk sharing in Table (3.17) emphasize the indirect channels.[96] The coefficients of most of the variables are robust across estimations, especially for the European countries. In particular, the strength of the indirect impacts stays comparatively unchanged for the European as well as for the Latin American countries. The consistent indirect influence is no surprise: changing the measure for risk sharing does not alter the channels between the three main variables: trade, specialization and business cycle co-movements.

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[96] In Table (3.17), data is disaggregated industry trade data. Risk sharing is measured by consumption correlations.

	Asia	Europe	Latin America
Risk	con_I		
Trade	0.0000	-0.0000	0.000002*
	(1.16)	(-0.19)	(2.53)
Spec	0.431***	0.0000	0.0000006***
	(8.55)	(1.62)	(8.17)
BC	0.0895***	-0.0600**	0.1015***
	(7.37)	(-3.13)	(9.83)
Trade			
Spec	0.0442***	0.256***	0.0534***
	(14.57)	(7.25)	(7.74)
GDP_i	0.4919***	0.1707***	0.1465***
	(4.39)	(5.50)	(3.54)
GDP_j	0.0427	0.1080***	0.2050***
	(0.40)	(3.65)	(4.91)
Spec			
Trade	0.1355***	0.0119**	-0.0052
	(12.21)	(2.87)	(-0.73)
Size	0.2182	-0.0121	-0.0275
	(0.45)	(-0.52)	(-1.00)
Finance	-0.5617	-0.1016	-0.2609
	(-0.18)	(-0.59)	(-0.34)
BC			
Trade	-0.0173***	0.133***	0.110*
	(-3.69)	(3.40)	(2.53)
Spec	-0.0248***	-0.692***	-0.00171
	(-9.07)	(-3.40)	(-0.03)
Finance	0.368**	-0.0843	0.171
	(2.67)	(-0.44)	(0.37)
N	711	613	731
R^2 Risk	-0.56	-0.84	-1.76
R^2 Trade	-0.54	-2.16	0.04
R^2 Spec	-0.05	-0.01	-0.01
R^2 BC	-0.31	-0.46	-0.03

t statistics in parentheses
$*p < 0.05$, $**p < 0.01$, $***p < 0.001$

Table 3.17. Direct and Indirect Impact on Risk Diversification separated by Country Groups.

However, the direct channels show a different impact on consumption correlation than on financial risk sharing. The most obvious change of the trade impact occurs for the Asian countries. In the case of consumption correlation, the influence of trade turns insignificant. This might be intuitive as Kim et al. (2006) point out that the credit market is not an important channel for risk sharing between the Asian countries. However, the results indicate that there is risk sharing between the Asian countries. Risk sharing also increases with trade between these countries but the credit market is not used for risk sharing activ-

ities. These considerations are confirmed by a moderate positive impact of business cycle co-movements on risk sharing. For the European countries, the effect of trade on consumption correlation remains insignificant. One notable change is the insignificant coefficient for the specialization impact on risk sharing. With increasing specialization between the countries, the composition of their consumption bundles adjusts more and more. The effect of business cycle co-movements remains significantly negative. For Latin America, increasing trade, specialization and business cycle co-movements boost the consumption correlation within the group. Again, none the industry estimation results varies between the analysed industries, indicating the robustness of these results.

3.5 Robustness

As a check for the robustness, we run the estimation with varying explanatory variables. For trade we implement two additional trade measures according to (3.97) and (3.98). Moreover, we construct measure (3.96) with different datasets. We also include two different specialization indices. For this purpose, we use value added industry data and data from two different data sets for measure (3.99). Business cycle co-movements are presented by current GDP correlation as well as GDP growth correlation. To all these alterations in the explanatory variables the results are robust. The only exception is the Asian country group with respect to the business cycle co-movement. Precisely, in the financial risk sharing estimation the correlation of the pure GDP data is dropped with any trade measure in the estimation. However, correlation of GDP growth can be used without difficulties with any trade measure.

We applied a second check for the explained variables. As a measure of consumption correlation we also used pure consumption correlation and the correlation of consumption growth. Again the results were all robust. Above all, with the consumption risk sharing, the Asian results with regard to business cycle co-movement do not display the dropped trade measure.

Finally, we switch the estimation method from 3sls to 2sls, and equation by equation estimation, as further tests of robustness. In both cases, the results are mostly robust for all country groups. Yet, specialization changes its impact on risk sharing in three country groups and the effect of business cycles on risk sharing for one group. The results are least robust for the Latin American countries.[97]

According to these sensitivity analyses, the results are robust. Only the results for the Latin American countries should be interpreted with caution.

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[97]   In addition to the 2sls and equation-by-equation estimation, we run the regression with a panel-corrected standard error method and a pooled linear standard method.

3.6 Conclusion

In this chapter, we analyse the impact of increasing trade, specialization and business cycle co-movements on risk-sharing within three country groups. Additionally, we study the simultaneous effects between these three explaining variables by allowing for endogeneity among them. In order to account for different stages of integration within a country group, we split the European and the Latin American countries in two different country groups: for Europe, CEEC and Core, and for Latin America, Central and South.

The results indicate that more similar countries share more risk with each other. These results are valid for the financial risk-sharing as well as for the consumption risk-sharing estimation. The impact of trade and specialization on risk sharing differs for each country group. The Asian and European Core countries increase their risk-sharing among each other the more diverse their industrial specialization is. In contrast, the CEEC and both Latin American country groups tend to increase their intra-group risk-sharing the more synchronized their industrial patterns are. Furthermore, trade always increases business cycle co-movements with the exception of the Latin American countries. On the other hand, specialization leads to diverging business cycles except for the CEEC. The mutual trade and specialization relations imply a noticeable impact of intra-industry trade in each country group. Again, the southern Latin American countries march to a different drummer and show a positive trade impact on specialization and vice versa.

Overall, the results imply that there is a tendency for synchronized countries with respect to industry patterns and business cycles to share their risk with each other. Within these respective country groups, intra-industry trade accounts for a noticeable share in total

trade. The Latin American country groups present an exception. Also, they also do not show the same share of intra-industry trade and they show a much weaker intra-group link.[98] Hence, there might be scope and need for further integration and risk sharing among the Latin American countries. This is a subject of growing importance, especially in course of a proceeding decoupling process from the USA.

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[98]   Interestingly, these "hard" fact results are supported by the Latinobarómetro (2007). This survey finds a rather weak will for integration among the Latin American population. Furthermore, the willingness for integration and bearing of possible concessions is lower in the southern than in the central Latin American countries. These findings again support the present results with more integrated and connected central Latin American countries than Latin American south.

3.7 Appendix

Countries

Asia
  Australia
  China
  Hong Kong
  Indonesia
  India
  Japan
  Korea, South
  Malaysia
  Myanmar
  New Zealand
  Philippines
  Singapore
  Thailand
  Taiwan
  Vietnam

Europe

Austria
Belgium
Bulgaria
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithunia
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovak Republic
Slovenia
Spain
Sweden
United Kingdom

Europe, Core

Austria
Belgium
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Luxembourg
Malta
Netherlands
Portugal
Spain
Sweden
United Kingdom

Europe, CEEC

Bulgaria
Cyprus
Czech Republic
Estonia
Hungary
Latvia
Lithuania
Poland
Romania
Slovak Republic
Slovenia

Latin America

Argentina
Bahamas, The
Bolivia
Brazil
Chile
Colombia
Costa Rica
Ecuador
El Salvador
Guatemala
Honduras
Mexico
Nicaragua
Panama
Paraguay
Peru
Uruguay
Venezuela

Latin America, Central

Costa Rica
El Salvador
Guatemala
Honduras
Mexico
Nicaragua
Panama

Latin America, South

Argentina
Bahamas, The
Bolivia
Brazil
Chile
Colombia
Ecuador
Paraguay
Peru
Uruguay
Venezuela

Control Variables

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
GDP$_i$	0.0265	-0.0178	0.421***	-0.590**	0.0785***
	(1.88)	(-0.56)	(3.96)	(-2.64)	(5.83)
GDP$_j$	-0.0154***	-0.0261***	-0.2130**	-0.5760**	0.1420***
	(-3.57)	(-3.71)	(-2.66)	(-2.95)	(10.49)
Language	0.5430***	0	0	0	0.0375***
	(24.51)	.	.	.	(3.66)
Border	0.0571***	0.1350***	0.1110**	0.0807	0.1510***
	(3.58)	(16.74)	(3.29)	(1.76)	(19.25)
Religion	-0.0044***	0.0003	0	0.1605***	-0.0200***
	(-4.48)	(0.58)	.	(4.43)	(-6.47)
Ethnik	0.2540***	0	0	-0.1690***	0.0916***
	(11.59)	.	.	(-3.71)	(9.56)
Democracy	0.0056	0.0626***	0	0	0
	(0.52)	(6.89)	.	.	.
Distance	-0.0834***	0.0183	-0.7670**	0.7080	-0.1252***
	(-4.00)	(0.93)	(-2.76)	(0.98)	(-3.71)

t statistics in parentheses

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.18. Trade Controls for Financial Risk Sharing

In Table (3.18) trade data is total trade data. Financial risk sharing is measured by net

foreign asset positions.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
Financial Depth	0.18841***	-0.0006*	0.0002	0.0011*	-0.0027
	(8.34)	(-2.36)	(1.56)	(2.51)	(-0.32)
Activity Int.	-0.2167***	0.0002	-0.0003*	-0.0009*	-0.0006
	(-9.44)	(0.70)	(-2.13)	(-2.38)	(-0.12)
Size Stock-Market	0.0250**	0.0002	-0.0001	-0.0001	0.0011
	(2.73)	(0.74)	(-0.49)	(-0.40)	(0.44)
Financial Development	-0.0505*	0.0004	-0.0003*	-0.0002	-0.0073
	(-2.38)	(1.18)	(-1.99)	(-0.65)	(-0.70)
Activity Stock-Market	0.0021	0.0002	-0.0001	0.0004	-0.0095
	(0.23)	(1.02)	(-0.84)	(0.44)	(-0.78)
Fin. Depth Partner	0.0701***	0.0033***	0.0001	0.0011*	-0.0043
	(6.40)	(12.36)	(0.24)	(2.52)	(-1.41)
Activity Int. Partner	-0.1440***	-0.0030***	-0.0001	-0.0009*	-0.0004
	(-9.85)	(-8.64)	(-0.68)	(-2.35)	(-0.09)
Size Stock-M. Partner	0.010	-0.0001	-0.0001	-0.0001	0.0023
	(1.69)	(-0.44)	(-0.06)	(-0.40)	(0.91)
Fin. Dev. Partner	0.0029	-0.0013***	-0.0006***	-0.0002	-0.0080
	(0.25)	(-5.63)	(-6.12)	(-0.75)	(-1.61)
Activity Stock-M. Partner	-0.0100	0.0013***	0.0001	0.0003	-0.0201
	(-1.39)	(6.95)	(0.43)	(0.36)	(-1.84)

t statistics in parentheses

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.19. Financial Controls for Financial Risk Sharing

In Table (3.19), trade data is total trade data. Financial risk sharing is measured by net foreign asset positions.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
GDP_i	0.0281*	-0.0117	0.446***	-0.736***	0.107***
	(1.99)	(-0.36)	(4.26)	(-3.35)	(8.92)
GDP_j	-0.0157***	-0.0263***	-0.256**	-0.692***	0.161***
	(-3.65)	(-3.65)	(-3.23)	(-3.61)	(12.73)
Language	0.545***	0	0	0	0.0416***
	(24.60)	.	.	.	(4.12)
Border	0.0577***	0.136***	0.0715*	0.100*	0.167***
	(3.61)	(16.64)	(2.16)	(2.23)	(21.87)
Religion	-0.0453***	0.0038	0	0	0
	(-4.55)	(0.64)	.	.	.
Ethnic	0.255***	0	0	-0.192***	0.0550***
	(11.64)	.	.	(-4.25)	(6.17)
Democracy	0.0046	0.0635***	0	0	-0.242***
	(0.43)	(6.63)	.	.	(-8.74)
Distance	-0.0073***	0.0014	-0.110***	0.021	-0.0006
	(-3.49)	(0.67)	(-4.05)	(0.29)	(-0.19)

t statistics in parentheses

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.20. Trade Controls for Consumption Risk Sharing

In Table (3.20), trade data is total trade data. Consumption risk sharing is measured by consumption correlation.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
Financial Depth	-0.00550	-0.174	0.403	-0.193	0.0462
	(-0.06)	(-0.92)	(0.90)	(-0.50)	(0.40)
Activity Int.	-0.0375	0.0207	-0.474	0.716*	-0.0097
	(-0.45)	(0.11)	(-1.10)	(2.17)	(-0.12)
Size Stock-Market	-0.0109	0.0677	-0.0160	-0.489*	0.0542
	(-0.33)	(0.33)	(-0.11)	(-1.97)	(1.53)
Finanical Development	0.0076	0.136	0.448	-0.964***	-0.0656
	(0.09)	(0.51)	(0.84)	(-4.33)	(-0.46)
Activity Stock-Market	0.001	0.0031	-0.017	0.233***	-0.109***
	(0.29)	(0.23)	(-1.18)	(3.40)	(-5.16)
Fin. Depth Partner	0.239***	0.0876	0.660*	-0.288	-0.0648
	(6.00)	(0.46)	(2.54)	(-0.75)	(-1.22)
Activity Int. Partner	-0.208***	-0.323	-0.514*	0.749*	0.0298
	(-3.91)	(-1.32)	(-2.35)	(2.30)	(0.37)
Size Stock-Market Partner	0.0840***	-0.118	0.138	-0.472	0.0779
	(3.81)	(-0.61)	(1.11)	(-1.87)	(1.77)
Fin. Dev. Partner	-0.0743	-0.0612	0.524	-0.919***	0.0842
	(-1.78)	(-0.38)	(1.70)	(-4.05)	(1.05)
Activity Stock-M. Partner	0.0008	0.0082	-0.0523***	0.230**	-0.134***
	(0.30)	(0.61)	(-4.33)	(3.28)	(-7.32)

t statistics in parentheses

$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.21. Financial Controls for Consumption Risk Sharing

In Table (3.21), trade data is total trade data. Consumption risk sharing is measured by consumption correlation.

Results of Robustness Check

	Asia	Europe CEEC	Europe Central	Latin America Central	Latin America South
Risk					
Trade^{CvW}	-0.1684***	-0.0002***	0.0005*	-0.0001**	-0.0103***
	(-10.57)	(-7.58)	(2.05)	(-2.87)	(-3.74)
Spec	-0.0475**	-0.1950***	0.0011***	-0.0013	-0.4246*
	(-3.11)	(-8.74)	(7.98)	(-0.76)	(-2.48)
BC	0.2652***	0.0005***	-0.0001	0.0002**	-0.0365***
	(9.71)	(4.59)	(-0.36)	(2.88)	(-4.26)
Trade					
Spec	-0.0018***	-0.320***	-0.001***	-0.0769***	-0.0071**
	(-15.61)	(-8.86)	(-9.65)	(-4.36)	(-3.26)
GDP$_i$	0.0012	-0.0175	0.0089*	-0.207*	-0.0128
	(0.23)	(-0.31)	(2.35)	(-2.15)	(-1.86)
GDP$_j$	-0.0001	-0.022	0.0009	-0.173*	0.0021
	(-0.12)	(-1.57)	(0.32)	(-2.05)	(0.31)
Spec					
Trade^{CvW}	-0.4933***	-0.0011***	-0.5091***	-0.0071***	-0.0208***
	(-22.08)	(-6.24)	(-5.66)	(-8.96)	(-4.36)
Size	-0.0554***	0.0007**	-0.0110	0.0001	0.0004
	(-4.37)	(2.60)	(-0.84)	(0.05)	(0.28)
Finance	-0.004**	0.0001	-0.0159	0.0002	0.0007
	(-2.96)	(1.89)	(-1.95)	(-0.75)	(1.35)
BC					
Trade^{CvW}	0.0502***	0.0107***	0.145***	-0.0042	-0.0062
	(22.17)	(8.23)	(6.61)	(-1.59)	(-1.67)
Spec	0.0021***	0.663***	0.0056	-0.0467	-0.0699***
	(5.69)	(8.90)	(1.89)	(-1.66)	(-11.36)
N	2011	1063	196	134	1030
R^2 Risk	-0.78	-1.73	-2.12	0.65	-1.54
R^2 Trade	-0.2	-0.58	0.47	0.38	-0.01
R^2 Spec	-0.56	0.06	0.25	0.20	-0.14
R^2 BC	-1.14	-0.53	0.30	0.05	-1.33

Table 3.22. Direct and Indirect Impact on Financial Risk Sharing

In Table (3.22), trade is measured by the third trade index analogue to Deardorff (1998). Trade data is total trade data. Risk sharing is measured by net foreign asset positions.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
	nfa_ij				
Risk					
Trade	-0.2241	-0.0403***	-0.0017***	-0.0023**	-0.0373
	(-1.30)	(-7.50)	(-3.78)	(-2.73)	(-0.93)
Spec 2	0.0903	-0.6631***	-0.0063***	0.0005	0.01
	(0.98)	(-9.48)	(-3.96)	(0.11)	(1.61)
BC	0.3115	0.0115***	-0.0002	0.0022**	-0.2584***
	(1.59)	(9.90)	(-0.44)	(3.18)	(-4.48)
Trade					
Spec 2	-0.0172***	0.253	0.0281	-0.486***	-0.0001
	(-14.91)	(1.51)	(0.60)	(-6.08)	(-0.02)
GDP_i	0.0227	-0.0179	0.553***	-0.202	0.0938***
	(1.66)	(-0.54)	(4.94)	(-0.97)	(6.86)
GDP_j	-0.0021	-0.0110	-0.275**	-0.191	0.154***
	(-0.56)	(-0.90)	(-3.13)	(-0.92)	(11.04)
Spec 2					
Trade	-0.1234***	-0.0024**	-0.0035	-0.0146***	0.0051
	(-11.59)	(-2.69)	(-1.04)	(-8.85)	(1.27)
Size	-0.110***	0.0008	0.0005	0.0004	0.0097
	(-3.72)	(0.95)	(0.06)	(0.04)	(1.14)
Finance	-0.1113***	0.0043**	0.1203	0.0033	0.0068
	(-4.16)	(3.06)	(1.61)	(0.29)	(0.28)
BC					
Trade	0.0198***	0.2901***	0.0285	-0.0283*	-0.0150**
	(4.62)	(9.96)	(1.87)	(-2.33)	(-3.23)
Spec 2	-0.0021***	0.466***	-0.0777***	-0.0186**	0.0003
	(-11.70)	(15.27)	(-17.76)	(-2.80)	(0.54)
Finance	-0.0478***	-0.349***	0.205	-0.0170	0.0031
	(-4.35)	(-7.49)	(0.61)	(-0.20)	(0.11)
N	2040	1070	202	134	1030
R^2 Risk	0.42	-1.73	-0.4	0.64	0.09
R^2 Trade	0.22	0.39	0.48	0.18	0.49
R^2 Spec	0.21	0.1	0.35	0.09	0.01
R^2 BC	0.22	-3.9	-5.74	-0.21	0.04

t statistics in parentheses
$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.23. Direct and Indirect Impact on Financial Risk Sharing

In Table (3.23), business cycle co-movements are measured by gdp growth correla-

tions. Trade data is total trade data. Risk sharing is measured by net foreign asset positions.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
Risk					
'Trade	-0.2578	-0.0297***	-0.0008	-0.0032***	-0.0216
	(-1.51)	(-6.18)	(-1.56)	(-3.95)	(-0.44)
Spec	0.0140	-0.1597***	0.0008***	-0.0029	-0.2169
	(1.05)	(-8.77)	(5.58)	(-1.60)	(-1.25)
BC III	0.3551	0.0078***	0.0011**	0.0017*	-0.2406**
	(5.79)		(2.65)	(2.26)	(-3.03)
Trade					
Spec	-0.0443***	-0.0543	-0.134***	-1.50***	0.410***
	(-19.07)	(-0.27)	(-5.18)	(-3.69)	(9.56)
GDP_i	0.0264	-0.0165	0.421***	-0.588**	0.0786***
	(1.87)	(-0.52)	(3.95)	(-2.63)	(5.84)
GDP_j	-0.0161***	-0.0282***	-0.211**	-0.574**	0.142***
	(-3.75)	(-4.02)	(-2.63)	(-2.95)	(10.49)
Spec					
FR_I	-0.536***	-0.0072*	-0.1411***	-0.0259***	0.0303***
	(-9.38)	(-2.26)	(-3.42)	(-6.95)	(3.88)
Size	-0.0050**	0.00007*	-0.0003	0.0001	0.0001
	(-3.26)	(2.10)	(-0.21)	(0.21)	(0.50)
Finance	-0.0005**	0.0001	-0.0022*	-0.0001	0.0001
	(-3.19)	(1.85)	(-2.41)	(-0.64)	(1.44)
BC III					
Trade	0.0338***	0.2226***	0.0474***	-0.0179	0.0085
	(8.31)	(10.59)	(5.57)	(-1.65)	(0.16)
Spec	-0.0025***	0.614***	-0.0027	-0.0469	-0.0670***
	(-8.76)	(9.72)	(-1.01)	(-1.79)	(-11.13)
Finance	-0.0370***	-0.210***	-0.717***	-0.0167	0.0519
	(-3.43)	(-6.52)	(-3.73)	(-0.19)	(1.64)
N	2040	1070	202	134	1030
R^2 Risk	0.42	-1.19	-1.32	0.62	-0.32
R^2 Trade	-0.01	0.33	0.40	0.45	0.01
R^2 Spec	0.22	0.11	0.17	0.18	0.01
R^2 BC III	0.28	-0.78	0.31	0.01	-1.18

t statistics in parentheses
$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.24. Direct and Indirect Impact on Financial Risk Sharing

In Table (3.24), business cycle co-movements are measured by gdp growth correlations. Trade data is total trade data. Risk sharing is measured by net foreign asset positions.

	Asia	Europe CEEC	Europe Core	Latin America Central	Latin America South
Risk	nfa_ij				
Trade	-0.7803	-0.0109	-0.0015	-0.0098	-0.9814***
	(-0.66)	(-0.68)	(-0.71)	(-1.63)	(-4.02)
Spec	-0.2008***	0.0754**	0.0007*	-0.0194	0.6729***
	(-3.37)	(2.67)	(2.00)	(-1.28)	(5.72)
BC	0.5674***	0.0017***	-0.001***	0.0009	0.0294
	(6.58)	(3.58)	(-4.29)	(1.76)	(1.48)
Trade					
Spec	-0.0024**	0.482***	-0.0411*	0.0078	0.0360**
	(-2.78)	(10.48)	(-2.36)	(0.02)	(2.95)
GDP_i	0.0029	-0.0016	0.0573***	-0.111***	0.0091***
	(1.95)	(-0.45)	(4.40)	(-4.86)	(6.47)
GDP_j	0.0003	-0.0020***	-0.0332***	-0.104***	0.0151***
	(0.78)	(-3.32)	(-3.38)	(-4.97)	(10.82)
Spec					
Trade	-0.2024***	0.0118***	-0.0661	-0.0133***	0.0147*
	(-4.55)	(6.94)	(-1.71)	(-3.63)	(2.43)
Size	-0.1448***	0.0008	-0.0032	0.0010	0.0014
	(-7.84)	(1.74)	(-0.15)	(0.28)	(0.81)
Finance	-0.0076***	0.0004	-0.0155	-0.0004	0.0009
	(-4.87)	(0.76)	(-1.55)	(-0.98)	(1.73)
BC III					
Trade	0.234***	0.846***	0.315***	0.304**	-0.147***
	(7.77)	(8.19)	(4.16)	(3.07)	(-4.15)
Spec	-0.0119***	0.262	0.0196	0.199	-0.0211
	(-8.01)	(1.42)	(1.23)	(0.75)	(-1.14)
Finance	-0.0287**	-0.121***	-0.486*	0.0003	0.0058
	(-2.71)	(-4.19)	(-2.48)	(0.00)	(0.20)
N	2040	1070	202	134	1030
R^2 Risk	0.43	0.59	0.53	0.68	0.27
R^2 Trade	0.56	0.42	0.51	0.60	0.50
R^2 Spec	0.25	0.21	0.21	0.27	0.02
R^2 BC III	0.34	0.28	0.37	0.22	0.03

t statistics in parentheses
$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 3.25. Direct and Indirect Impact on Risk Sharing with OLS

In Table (3.25), trade is measured by total trade data. Risk sharing is measured by net foreign asset positions.

Chapter 4
Conclusion

In this work, we have presented the impact of international integration from various perspectives: workers, firm owners and countries. We emphasized the dependence of trade integration and financial integration for these three groups. The results indicate that integration has not one large impact but consists of many small effects.

The first link between trade integration and financial integration for individuals can already be found in 1846. The importance of trade opening is shown in the repeal of the corn laws in Great Britain. Additionally, the possible gains from financial diversification and the independence of one specific production factor are emphasized. However, until today the insurance issue of tariffs is still an argument for protectionism. On the other hand, the role of financial markets as insurance instrument for individuals is mainly underestimated.

For firms, international integration tightens their possible gains on the home market. International investment becomes more important in order for firms to survive. Therefore, various international investment instruments are needed, and continuing R&D to increase productivity and competitiveness are crucial for prospective firms.

Finally, the conditions in one country and the economic landscape are important impact factors for individual and firms' behaviour. Furthermore, as a consequence of proceeding integration countries have to take spillovers and impacts into account from the neighbouring countries and trading partners. Economic changes in neighbouring countries

impact the home country through various channels and affect individual and firm behaviour.

To handle these issues, we diveded the work in three main chapters.

Firstly, we addressed the impact of trade protection on the investment behaviour of a working individual. On the one hand, trade liberalisation increases uncertainty for the worker due to higher competition and increasing imports. On the other hand trade, liberalisation stimulates the workers' asset market activities and thus asset markets can act as a substitute for the diminished insurance caused by reduced trade protection. However, the results depend strongly on the industry structure of the respective country.

Secondly, the firm perspective and the arising investment possibilities were studied. According to the results, FPI can dampen small and short-term environment changes of the long-term FDI. Consequently, FPI and FDI can act as strategic complements. Thus, the combined investment of FDI and FPI increases the valuation and the expected cash flow of the respective instrument. Again, the country conditions are the crucial factor for the location decision of either international investment instrument.

As the first chapter shows, country structure seems to be a decisive factor for different investor groups. Thus, in Chapter 3 we presented the impact of international integration through various direct and indirect channels on the industrial patterns, trade and business cycle behaviour on three large country groups. Our results indicate that countries with synchronized industry patterns and business cycle share more risk with each other. For these countries trade consists of a high share of intra-industry trade.

Obviously, increasing international integration facilitates international risk sharing. Individuals in integrating countries might still face additional uncertainty due to the integration process but they also have an increased possibility to share their risk through various channels. One condition may not be neglected: proceeding liberalization of asset markets in various regions is a driving force for risk sharing and should be further advanced.

The results of the present work suggest that there is no possibility for countries, firms or individuals to refuse the further process of international integration. There are too many channels through which various effects impact countries, their industries and their people. However, there are also additional instruments arising to use international integration for each individual advantage. The only task to undertake then is to identify these instruments and to be willing to use them even if they are new and unfamiliar.

References

Abel, Andrew B. (1973): Optimal Investment under Uncertainty, American Economic Review, Vol. 73, pp. 228-233.

Acemoglu, Daron; Aghion, Philippe; Griffith, Rachel and Zilibotti, Frank (2004): Vertical Integration and Technology: Theory and Evidence, NBER Working Paper, No. 10997.

Adda, Jérôme and Cooper, Russel (2003): Dynamic Economics, MIT Press, Cambridge.

Aitchison, John and Brown, James A. C. (1973): The Lognormal Distribution with special References to its uses in Economics, Cambridge University Press, London.

Aizenman, Joshua (2008): On the Hidden Links between Financial and Trade Opening, Journal of International Money and Finance, Vol. 27, pp. 372-386.

Aizenman, Joshua and Marion, Nancy (2004): The Merits of Horizontal versus Vertical FDI in the Presence of Uncertainty, Journal of International Economics, Vol. 62, pp. 125-148.

Albuquerque (2003): The Compositions of International Capital Flows: Risk Sharing through Foreign Direct Investment, Journal of International Economics, Vol. 61, pp. 353-383.

Andersen, Palle. S. and Hainaut, Philippe (1998): Foreign Direct Investment and Employment in the Industrial Countries, Bank for International Settlements, Working Paper, No. 61.

Asdrubali, Pierfederico; Sorensen, Bent E. and Yosha, Oved (1996): Channels of Interstate Risk Sharing: United States 1963 - 1990, Quarterly Journal of Economics, Vol. 111, pp. 1081-1110.

Athanasoulis, Stefano G. and van Wincoop, Eric (2001): Risk Sharing Within the United States: What do Financial Markets and Fiscal Federalism Accomplish?, Review of Economics and Statistics, Vol. 83, pp. 688-698.

Baldwin, Robert E. (1982): The Political Economy of Protectionism. In: Bhagwati, Jagdish N. (eds) Import Competition and Response. The University of Chicago Press, Chicago.

Baxter, Marianne and Crucini, Mario J. (1995): Business Cycles and the Asset Structure of Foreign Trade, International Economic Review, Vol. 36, pp. 821 - 854.

Bayoumi, Tamim and Klein, Michael W. (1997): A Provincial View of Economic Integration, IMF Staff Paper, Vol. 44, pp. 534 - 556.

Beck, Torsten; Demirgüc-Kunt, Asli and Levine, Ross (1999): A New Database on Financial Development and Structure, World Bank Working Paper, No. 2146.

Bertaut, Carol C. and Haliassos, Michael (1997): Precautionary Portfolio Behavior from a Life-cycle Perspective, Journal of Dynamics and Control, Vol. 21, pp. 1511-1542.

Bodie, Zvie; Merton, Robert C. and Samuelson, William F. (1992): Labor Supply Flexibility and Portfolio Choice in a Life-Cycle Model, Journal of Economic Dynamics and Control, Vol. 16, pp. 427-449.

Bodnar, Gordon M.; Marston, Richard C. and Hayt, Greg (1998): 1998 Survey of Financial Risk Management by U.S. Non-Financial Firms, George Weiss Center for International Financial Research, Wharton School, University of Pennsylvania.

Brooks, Robin and Del Negro, Marco (2004): The Rise in Comovement across National Stock Markets: Market Integration or IT Bubble?, Journal of Empirical Finance, Vol. 11, pp. 659-680.

Brooks, Robin and Del Negro, Marco (2005): A Latent Factor Model with Global Country, and Industry Shocks for International Stock Returns, IMF Working Paper No. WP/05/52.

Busse, Matthias; Hefeker, Carsten and Koopmann, Georg (2004): Between Two Poles: Matching Trade and Exchange Rate Regimes in Mercosur, North American Journal of Economics and Finance, Vol.17, pp. 349-362.

Byers, John (2007): Chemical Ecology of Insects, http://www.chemical-ecology.net/java/capitals.htm.

Campa, José M. and Fernandes, Nuno (2006): Sources of gains from international portfolio diversification, Journal of Empirical Finance, Vol. 13, pp. 417 - 443.

Campbell, John Y. and Viceira, Luis M. (2001): Appendix to Strategic Asset Allocation: Portfolio Choice for Long-Term Investors, http://kuznets.fas.harvard.edu/ ~campbell/papers/bookapp.pdf.

Campbell, John Y. and Viceira, Luis M. (2003): Strategic Asset Allocation: Portfolio Choice for Long-Term Investors, Oxford University Press, New York.

Cassing, James H. (1995): Protectionist mutual funds, European Journal of Political Economy, Vol.12, pp. 1-18.

Christiano, Lawrence J. and Fitzgerald, Terry J. (2003): The Band Pass Filter, International Economic Review, Vol. 44, pp. 435 - 465.

Chuhan, Punam; Perez-Quiros, Gabriel and Popper, Helen (1996): International Capital Flows. Do Short-Term Investment and Direct Investment Differ?, The World Bank, Policy Research Working Paper No. 1669.

CIA World Factbook (2008): https://www.cia.gov/library/publications/the-world-factbook/.

Clark, Todd E. and van Wincoop, Eric (2001): Borders and Business Cycles, Journal of International Economics, Vol. 55, pp. 59 - 85.

Cole, Harold L. and Obstfeld, Maurice (1991): Commodity Trade and International Risk Sharing - How much do Financial Markets matter?, Journal of Monetary Economics, Vol. 28, pp. 3-24.

Costello, Donna M. (1993): A Cross-Country, Cross-Industry Comparison of Productivity Growth, Journal of Political Economy, Vol. 101, pp. 207-222.

Crucini, Mario J. (1999): On International and National Dimensions of Risk Sharing, Review of Economics and Statistics, Vol. 81, pp. 73 - 84.

Deardorff, Alan V. (1998): Determinants of bilateral Trade: Does Gravity Work in a Neoclassical World?, in Frankel, Jeffrey A. (editor): The Regionalization of the World Economy, The University of Chicago Press, Chicago.

Del Negro, Marco (2002): Asymmetric shocks among U.S. states, Journal of International Economics, Vol. 56, pp. 273 - 297.

Ding, Qing; Dong, Lingxiu and Kouvelis, Panos (2007): On the Integration of Production and Financial Hedging Decisions in Global Markets, Operations Research, Vol. 55, pp. 470-489.

Dixit, Avinash K. and Pindyck, Robert S. (1994): Investment under Uncertainty, Princeton University Press.

Dixit, Avinash K. and Stiglitz, J. (1977): Monopolistic Competition and Optimum Product Diversity, American Economic Review, Vol. 67, pp. 297-308.

Drèze, Jacques H. and Modigliani, Franco (1972): Consumption Decision under Uncertainty, Journal of Economic Theory, Vol. 5, pp. 308-335.

Dunning, John H. (1973): The Determinants of International Production, Oxford Economic Papers, New Series, Vol. 25, pp. 289-336.

Eaton, Jonathan and Grossman, Gene M. (1985): Tariffs as Insurance: Optimal Commercial Policy when Domestic Markets are incomplete, Canadian Journal of Economics, Vol. 18, pp. 258–272.

Eichengreen, Barry and Park, Yung Chul (2003): Why has there been less Financial Integration in Asia than in Europe?, Institute of European Studies, Political Economy of International Finance, Working Paper PEIF-4.

Feeney JoAnne and Arye L. Hillmann (2004): Trade Liberalization through Asset Markets, Journal of International Economics, Vol. 64, pp. 151-167.

Feeney, JoAnne and Jones, Ronald W. (1994): Risk Aversion and International Markets: Does Asset Trade Smooth Real Income?, Review of International Economics, Vol. 2, pp. 13-26.

Fidrmuc, Jarko (2004): The Endogeneity of the Optimum Currency Area Criteria, Intra-Industry Trade, and EMU Enlargement, Contemporary Economic Policy, Vol. 22, pp. 1-12.

Fishlow, Albert and Haggard, Stephan (1992): The United States and the Regionalisation of the World Economy, OECD.

Frankel, Jeffrey A. and Rose, Andrew K. (1998): The Endogeneity of the Optimum Currency Area Criteria, The Economic Journal, Vol. 108, pp. 1009 - 1025.

Gates, Stephen (2006): Incorporating Strategic Risk into Enterprise Risk Management: A Survey of Current Corporate Practice, Journal of Applied Corporate Finance, Vol. 18, pp. 81-90.

Goetzmann, William N. and Kumar, Alok (2004): Equity Portfolio Diversification, Yale ICF Working Paper No. 00-59.

Goldstein, Itay and Razin, Assaf (2005): Foreign Direct Investment vs Foreign Portfolio Investment, NBER Working Paper, No. 11047.

Gollier, Christian (2001): The Economics of Risk and Time. The MIT Press, Cambridge.

Gollier, Christian and Schlee, Edward E. (2006): Increased Risk-Bearing with Background Risk, The B.E. Journal of Theoretical Economics, Vol. 6, Art. 3, pp. 1249-1249.

Graham, John R. and Smith Jr., Clifford W. (1999): Tax Incentives to Hedge, Journal of Finance, Vol. 54, pp. 2241-2262.

Grossman, Gene M.; Helpman, Elhanan and Szeidl, Adam (2005): Complementarities between Outsourcing and Foreign Sourcing, American Economic Review, Vol. 95, pp. 19-24.

Grossman, Gene M.; Helpman, Elhanan and Szeidl, Adam (2006): Optimal Integration Strategies for the Multinational Firm, Journal of International Economics, Vol. 70, pp. 216-238.

Guerin, Selen S. (2006): The Role of Geography in Financial and Economic Integration: A comparative Analysis of Foreign Direct Investment, Trade and Portfolio Investment Flows, World Economy, Vol. 29, pp.189-209.

Hardy, Darel W. and Walker, Carol L. (2003): Doing Mathematics with Scientific Work-Place & Scientific Notebook. MacKichan Software, Washington.

Harms, Philipp and Hefeker, Carsten (2003): Globalization and Unemployment: the Role of International Diversification, Economic Letters, Vol. 78, pp. 281–286.

Heathcote, Jonathan and Perri, Fabrizio (2003): Why has the U.S. Economy become less correlated with the Rest of the World?, American Economic Review, Vol. 93, pp. 63 - 69.

Heathcote, Jonathan and Perri, Fabrizio (2004): Financial Globalization and Real Regionalization, Journal of Economic Theory, Vol. 119, pp. 207-243.

Heaton, John and Lucas, Deborah (2000a): Portfolio Choice and Asset Prices: The Importance of Entrepreneurial Risk, The Journal of Finance, Vol. 55, pp. 1163-1198.

Heaton, John and Lucas, Deborah (2000b): Portfolio Choice in the Presence of Background Risk, The Economic Journal, Vol. 110, pp. 1-26.

Helpman, Elhanan (2006): Trade, FDI, and the Organization of Firms, Journal of Economic Literature, Vol. 64, pp. 589-630.

Helpman, Elhanan; Melitz, Marc J.and Yeaple, Stephen R. (2003): Export versus FDI, NBER Working Paper, No. 9439.

Hess, Gregory D. and Shin, Kwanho (1998): Intranational Business Cycles in the United States, Journal of International Economics, Vol. 44, pp. 289-313.

Hess, Gregory D. and Shin, Kwanho (2000): Risk Sharing by households within and across Regions and Industries, Journal of Monetary Economics, Vol. 45, pp. 533-560.

Holt, Richard W.P. (2003): Investment and dividends under irreversibility and financial constraints, Journal of Economic Dynamics and Control, Vol. 27, pp. 467-502.

Imbs, Jean (2004): Trade, Finance, Specialization, and Synchronization, The Review of Economics and Statistics, Vol. 86, pp. 723 - 724.

IMF (1993): Balance of Payments Manual, 5th Edition, International Monetary Fund, Washington DC.

IMF (2007): World Economic Outlook, October 2007.

IMF (2007): Direction of Trade Statistics: http://www.esds.ac.uk/international/support/user_guides/imf/dot

Inter-Secretariat Working Group on National Accounts (1993): System of National Accounts, Brussels/Luxembourg, New York, Paris, Washington, DC, Eurostat, IMF, OECD, United Nations, and World Bank.

Jermann, Urban J. (2002): International Portfolio Diversification and Endogenous Labor Supply Choice, European Economic Review, Vol. 46, pp. 507-522.

Judd, Kenneth L. (1998) : Numerical methods in economics, MIT Press, Cambridge.

Juillard, Christian (2004): Human Capital and International Portfolio Choice, LSE Research Online, Working Paper, ID Code 4813.

Kim, David and Sheen, Jeffrey (2007): Consumption Risk-sharing within Australia and with New Zealand, The Economic Record, Vol. 83, pp. 46 - 59.

Kim, Soyoung; Kim, Sunghyun H. and Wang Yunjong (2006): Financial Integration and Consumption Sharing in East Asia, Japan and the World Economy, Vol. 18, pp. 143 - 157.

Klos, Alexander and Weber, Martin (2006): Portfolio Choice in the Presence of Nontradeable Income: An Experimental Analysis, German Economic Review, Vol. 7, pp. 427-448.

Krebs, Tom; Krishna, Pavin and Maloney, William (2005): Trade Policy, Income Risk and Welfare, NBER Working Paper No. 11255.

Krugman, Paul R. (1993): Lessons of Massachusetts for EMU, in: Giavazzi, F., Torres, F. (editors): The Transition to Economic and Monetary Union in Europe, Cambridge University Press, New York.

Labhard, Vincent and Sawicki, Michael (2006): International and intranational consumption risk sharing: the evidence for the United Kingdom and OECD, Bank of England, Working Paper No. 302.

Lane, Philip and Milesi-Ferretti, Gian Maria (2001): The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Countries, Journal of International Economics, Vol. 55, pp. 263 - 294.

Latinobarómetro (2007): Opportunities for regional Integration II.

Lim, Sonya S. and Wang, Heli (2007): The effect of financial hedging on the incentives for corporate diversification: The role of stakeholder firm-specific investments, Journal of Economic Behaviour & Organization, Vol. 62, pp. 640-656.

Lipsey, Robert E. (1988): Changing Patterns of International Investment in and by the United States, in: Feldstein, Martin (ed.): The United States in the World Economy, Chicago.

Lipsey, Robert E. (1999): The Role of Foreign Direct Investment in International Capital Flows, in: Feldstein, Martin (ed.): International Capital Flows, Chicago.

Lipsey, Robert E. (2003): Foreign Direct Investment and the Operations of Multinational Firms: Concepts, History and Data, in: Choi, E. K. and Harrigan, J. (ed.): Handbook of International Trade, Wiley-Blackwell, Oxford.

Markowitz, Harry M. (1987): Mean-Variance Analysis in Portfolio Choice and Capital Markets. Basil Blackwell, New York.

Markusen, James R. and Maskus, Keith E. (2001): General-Equilibrium Approaches to the Multinational Firm: A Review of Theory and Evidence, in: Choi, E. K. and Harrigan, J. (ed.): Handbook of International Trade, Wiley-Blackwell, Oxford.

Massa, Massimo and Simonov, Andrei (2006): Hedging, Familiarity and Portfolio Choice, Review of Financial Studies, Vol. 19, pp. 633-685.

Mayer, Wolfgang (1984): Endogenous Tariff Formation, American Economic Review, Vol 74, pp. 970-985.

Melitz, Marc J. (2003): The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity, Econometrica, Vol. 71, pp. 1695 - 1725.

Mello, Antonio S.; Parsons, John E. and Triantis, Alexander J. (1995): An integrated model of multinational flexibility and financial hedging, Journal of International Economics, Vol. 39, pp. 27-51.

Mody, Ashoka; Razin, Assaf and Sadka, Efraim (2002): The Role of Information in driving FDI: Theory and Evidence, NBER Working Paper, No. 9255.

Mukhametdinov, Mikhail (2007): Mercosur and the European Union, Variation among the Factors of Regional Cohesion, Journal of Nordic International Studies Association, Vol. 42, pp. 207 - 228.

Nocco, Brian W. and Stulz, René M. (2006): Enterprise Risk Management: Theory and Practice, Journal of Applied Corporate Finance, Vol. 18, pp. 8-20.

Pakko, Michael R. (1997): International Risk Sharing and Low Cross-Country Consumption Correlation: Are they really inconsistent?, Review of International Economics, Vol. 5, pp. 386 - 400.

Penn World Table Version 6.2, Alan Heston, Robert Summers and Bettina Aten, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September 2006.

Pflaumer, Peter; Heine, Barbara and Hartung Joachim (2001): Statistik für Wirtschafts- und Sozialwissenschaften: Deskriptive Statistik. Oldenbourg, München.

Prasad, Eswar; Rogoff, Kenneth; Wei Shang-Jin and Kose, Ayhan M. (2003): Effects of Financial Globalization on Developing Countries: Some Empirical Evidence, IMF Occasional Paper No. 220.

Razin, Assaf (2002): FDI Contribution to Capital Flows and Investment in Capacity, NBER Working Paper, No. 9204.

Reisen, Helmut and van Trotsenburg, Axel (1988): Should the Asian NICs peg to the Yen?, Intereconomics, Vol. 23, pp. 172 - 177.

Renström, Thomas R. and Roszbach, Kaspar (1995): Trade Unions, Employee Share Ownership and Wage Setting: a Political-Economy Approach, SSE/EFI Working Paper Series in Economic and Finance, No. 65.

Rodríguez-Pose, Andrés and Gill, Nicholas (2006): How does Trade affect regional Disparities?, World Development, Vol. 34, pp. 1201 - 1222.

Rose, Andrew K. and van Wincoop, Eric (2001): National Money as a Barrier to International Trade: The real Case for Currency Union, American Economic Review, Vol. 91, pp. 386-390.

Schonhardt-Bailey, Cheryl (1991): Specific factors, capital markets, portfolio diversification, and free trade: Domestic determinants of the repeal of the Corn Laws," World Politics, Vol. 43, pp. 545-569.

Schonhardt-Bailey, Cheryl (ed.) (1996): Free Trade: The Repeal of the Corn Laws, Thoemmes Press, Bristol.

Sorensen, Bent E. and Yosha, Oved (1998): International Risk Sharing and European Monetary Unification, Journal of International Economics, Vol. 45, pp. 211 - 238.

Stulz, René M. (1984): Optimal Hedging Policies, Journal of Financial & Quantitative Analysis, Vol. 19, pp. 127-140.

Svaleryd, Helena and Vlachos, Jonas (2002): Markets for risk and openness to trade: how are they related, Journal of International Economics, Vol. 57, pp. 369-395.

Svaleryd, Helena and Vlachos, Jonas (2003): Financial Markets, the Pattern of Industrial Specialization and Comparative Advantage: Evidence from OECD Countries, European Economic Review, Vol. 49, pp. 113 - 144.

Tamirisa, Natalia T. (1999): Exchange and Capital Controls as Barriers to Trade, IMF Staff Papers, Vol. 46, pp. 69-88.

Viceira, Luis M. (2001): Optimal portfolio choice for long horizon investors with nontradeable labor income, Journal of Finance, Vol. 56, pp. 433-470.

Wei, Shang-Jin and Wu, Yi (2002): The Life-And-Death Implication of Globalization, IMF Working Paper, No. 11-8-02.

Weitzman, Martin (1984): The Share Economy. Harvard University Press, Cambridge.

Wooldridge, Jeffrey M. (2002): Econometric Analysis of Cross Section and Panel Data, MIT Press, Cambridge.

World Bank (2007): World Development Indicator: http://data.worldbank.org/indicator.

WTO (1996): Trade and foreign direct investment, New Report by WTO, www.wto.org/ English/news_e/pres96_e/pr057_e.htm.

WTO (2008): World Trade Report.

UN Comtrade database (2008): http://comtrade.un.org/.

UNCTAD (2006): World Investment Report 2006, http://www.unctad.org/en/docs/wir2006_en.pdf.

Unido Industrial Database (2007): http://www.esds.ac.uk/international/support/user_guides/unido/indstat.a

Zellner, Arnold and Theil, Henri (1962): Three-Stage Least Squares: Simultaneous Estimation of Simultaneous Equations, Econometrica, Vol. 30, pp. 54 - 78.