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Labour mobility and international trade

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Abstract

Motivation: The academic debate on whether the relationship between factor mobility and international trade is one of complementarity or substitution is inconclusive. In general, the relationship between the two can vary depending on the specific research methodology and the object of study. Moreover, there are fewer empirical analyses with China and the European Union as subjects, so studying the relationship between labour mobility and trade in the case of China and Europe is worthwhile.
Aim: The purpose of this paper is to determine, through empirical analysis, the relationship between labour mobility in the form of dispatched labour and bilateral trade between China and the European Union in the period of 2005–2021.
Materials and methods: This paper utilises quantitative analysis to investigate the relationship between labour movements and trade (imports and exports) based on data from 2005 to 2021, primarily through co-integration analysis and Granger causality testing.
Results: The study found that there is a substitution relationship between the number of dispatched labour from China and the trade in goods between China and the European Union in the research period. Additionally, Granger causality tests show that China's dispatched labour to the EU is the Granger cause of China-EU export trade, and vice versa. However, China's dispatched labour to the EU is not a Granger cause of China-EU import trade.

Keywords: *international trade; dispatched labour; labour mobility*
JEL: *C22; F14; F22*

1. Introduction

The years of economic globalization have brought about a boom in global trade and a growing international labour market, making international labour mobility a widespread and significant economic phenomenon. As crucial variables in economics, international trade and international labour mobility have attracted the attention of many economists, particularly with regards to the relationship between the two. However, whether the relationship between the international mobility of factors of production and international trade is one of substitution, complementarity, or both is currently inconclusive in international scholarship. This uncertain relationship was the main motivation for choosing the topic of this paper. Additionally, the study of the relationship between labour mobility and international trade has practical implications for the formulation and improvement of national and regional migration and trade policies. Therefore, this paper mainly focuses on the relationship between labour mobility and international trade on the example of China and the European Union (EU) during 2005–2021.

Both China and the EU are significant players on the world economic stage. The EU, as an early developed country organization, plays a pivotal role in national trade markets and international labour markets. China rapidly joined international trade after the reform and opening up, and after more than 30 years of rapid development, it has become a leader among developing countries. As of 2021, China's share of world export trade reached 18.4%, ranking first, while the EU was second at 14.1%. China is also the second largest importer in the world, with 14.4% of the world's imports, while the EU ranks third with 13.5% of world trade, according to Eurostat (2023). Since 1983, China and the European Union have been strengthening their cooperation and have achieved important results in the economic field. In 2022, China was the third largest partner for EU exports of goods, accounting for 9.0% of the total, and the largest partner for EU imports of goods, accounting for 20.8% of the total, according to Eurostat (2023). This is evidence of the extensive economic cooperation between China and the EU. The latest data from the General Administration of Customs of the People's Republic of China (2023a; 2023b) shows that the trade volume between China and the EU has reached 847.32 billion dollars in 2022.

Over the past decade or so, China has developed its own system of sending labour abroad, which, despite its shortcomings, has been active in the international labour flow. Over the past 50 years, labour from China has flowed to all continents, including Europe. According to the explanation provided by the National Bureau of Statistics of China (2012), "Overseas Labour Services refer to domestic corporations which have signed contracts with overseas corporations, intermediary agencies, and private employers, and are allowed to recruit or hire foreign labour forces. They will send Chinese citizens to go abroad to provide labour services to foreign employers through organized recruitment and selection according to the signed contracts and relevant management activities". Additionally, internationally dispatched labour is a type of international regrouping and reallocation of labour factors. Labour mobility between China and the European Union is gradually coming into the public eye based on the labour dispatch system, and with the increasing number of Chinese enterprises going abroad, the Chinese labour force is also significantly influencing Sino-European relations. However, there is a lack of research on this type of labour mobility, especially with China and the EU as the subject of study. This is a further motivation for choosing this topic for this paper.

This paper's hypothesis was that there is a substitution between labour mobility and international trade in the case of China and the EU.

The study consists of five parts, including an introduction and conclusion. The introduction presents the background of the study and the significance of the research, briefly introducing trade flows and labour mobility between China and the EU. The Section 2 focuses on literature review, specifically on the mainstream view on factor mobility and international trade flows, with a particular emphasis on the current impact of labour mobility as a single factor on international trade. The Section 3 introduces data and the methodology, including cointegration analysis and Granger causality tests. The results of the empirical analysis are interpreted in the Section 4. The conclusion presents the main findings.

2. Literature review

Much of the early research on the relationship between international labour mobility and international trade focused on the general connection between factor mobility and trade. Research on the cross-border mobility of factors of production and international trade began in the late 1950s, and after continuous development and refinement, two main views can be summarized. One is the substitution argument, which posits that the movement of factors of production will replace the international movement of commodities (Markusen, 1983; Mundell, 1957; Svensson, 1984). The second is the view of complementarity, which suggests that the international flow of factors of production and goods complement each other and promote each other (Collins et al., 1997; Krugman, 1995). As a matter of fact, in the early theories of international trade, it was generally accepted that there was a substitution relationship between the two. However, as theoretical and empirical research has progressed, the relationship between the two has yielded different results depending on the research method or the object of study.

2.1. A study on factor mobility and international trade

In fact, research on the cross-border mobility of factors of production and international trade is not a new phenomenon. The first scholar to formally study the relationship between cross-country factor movements and international trade was Mundell (1957, p. 1), who conducted an in-depth analysis of cross-country factor movements by constructing a two-country, two-factor, two-commodity model. He found that "commodity movements are at least to some extent a substitute for factor movements". Purvis (1972) found no substitution between factor flows and trade by relaxing the assumptions of the Heckscher–Ohlin–Samuelson model while taking into account technological differences between countries. Markusen and Svensson (1983) also focused on the existence of technological differences between countries. They developed a general model of trade induced by technological differences and analyzed factor flows under this model, finding complementarities between factor trade and merchandise trade. Kojima (1973, p. 1), by studying foreign direct investment (FDI) in the US and Japan, proposed two different types of FDI, namely "trade-oriented (the Japanese type) and anti-trade-oriented (the American type)". He points out that trade-oriented FDI not only facilitates industrial upgrading on both sides but also promotes bilateral trade, in other words, the complementary relationship between the package of factor flows brought about by FDI and trade. In fact, FDI, as a special form of factor movement, has attracted many scholars to analyze its possible relationship with international trade by looking at other countries or regions (Bhagwati et al., 1987; Goldberg & Klein, 1997; 1999; Head & Ries, 2001; Helpman & Krugman, 1987; Lipsey & Weiss, 1981; Pain & Wakelin, 1998; Pfaffermayr, 1996; Xiong & Sun, 2021). Markusen (1983) argued for a substitution relationship between trade in goods and factor trade, but only if it was based on a factor proportion model; in other words, this substitution relationship was only a general feature of the Heckscher–Ohlin model. Svensson (1984) found that the relationship between factor trade and trade in goods can have different results depending on whether the traded and non-traded factors are "cooperative". Neary (1995) suggests that factor trade and trade in goods may be substitutes when funds flow to the import sector, with the opposite result when the funds flow to the export sector. Krugman (1995) made an important contribution to the development of the new trade theory. Taking into account increasing returns to scale in his trade model, he found that when there are increasing internal returns to scale, this leads to different returns to factors, thus generating factor mobility, increasing inequality of endowments between countries and making trade increase, and it can be argued that there is complementarity between factor mobility and trade. Using historical analysis, Collins et al. (1997) examine the relationship between trade and factor mobility, particularly the movement of labour factors. It turns out that trade and factor mobility have complemented each other in different historical contexts.

In conclusion, research on the relationship between factor mobility and trade provides a wealth of theoretical and empirical studies, as well as direction for the study of single factor mobility, which is the topic of this paper.

2.2. A study on labour mobility and international trade

Gould (1994) argues from the perspective of immigration links that immigrants can transmit knowledge to their home countries through spillover effects that contribute to lower information costs. This, in turn, facilitates trade flows between the two sides. Collins et al. (1997), in their study of factor mobility, focused on labour factor mobility and found a complementary relationship between immigration flows and trade. Dunlevy and Hutchinson (1999, p. 1058) used a gravity model with the United States as the country of study, collecting 78 commodities from 17 countries, and showed that "the protrade effect of migrant stock was found to have been important every year from 1870 through 1900". Bruder (2004) examines the relationship between labour migration from Spain, Portugal, Greece, Italy, and Turkey, and national trade in Germany between 1970 and 1998, and found evidence of a substitution relationship. Jacks (2005) examined the impact of labour immigration on international trade in Atlantic economies between 1870 and 1913 and found an ambiguous relationship between the two that was neither complementary nor substitutionary. Preibisch (2007) discovered that the inflow of temporary visa workers into Canada provided a flexible workforce for the Canadian agricultural industry, thereby increasing Canada's competitiveness in international trade markets. Genc et al. (2012), through a meta-analysis of 48 studies on the stock of immigration and import and export flows, revealed that immigration complements trade flows between host and origin countries.

In summary, most of the research on labour mobility and trade is based on the perspective of labour immigration, but less on transnational labour mobility in the form of national dispatch.

3. Materials and methods

3.1. Research data

In this paper, the variable "dispatched labour" is chosen to capture the movement of labour factors from China to the EU. Actually, the dispatched labour flows between China and the EU started late, and since the EU underwent an important enlargement in 2004 when ten Central and Eastern European countries successfully joined the EU, the time period chosen for the empirical analysis is 2005 to 2021 for the accuracy of the results.

Table 1 presents the number of people sent by China to the EU for labour cooperation and the value of import and export merchandise trade between China and the EU. The main source of the data is the Ministry of Commerce of the People's Republic of China (MOFCOM, 2023) and the National Bureau of Statistics of China (2022), where the number of people sent to the EU by China in the past years is calculated according to the Chinese statistical yearbook. The co-integration analysis and Granger causality test analysis were conducted based on these three variables: the number of labour for labour cooperation (LAB), the value of export (EX), and the value of import (IM). The econometric software used in this paper is Gretl.

3.2. Metchods

In the paper the quantitative analysis was chosen to analyze the relationship between labour movement (LLAB) and commodities trade (LEX and LIM). In order to eliminate heteroskedasticity between the data, the new variables, LLAB, LEX and LIM, were obtained by taking logarithms of the selected variables before the empirical analysis. Specifically, the research process included three parts. The first part mainly involved stationary testing of the time series, as only non-stationary series can undergo cointegration analysis. The second step was cointegration analysis, which can determine whether there is a long-term stable relationship between two non-stationary series and is an important method in time series analysis. Since this is a bivariate cointegration analysis, the Engle–Granger (EG) two-step method was used. An OLS regression analysis was involved firstly, followed by a residual stability test. In the third step, the direction of influence between the two variables through Granger causality analysis was identified, i.e., finding the independent and dependent variables.

In summary, through these three steps, it is possible to determine not only whether there is an equilibrium relationship between the two variables in the long run but also to understand the short-term causality between the variables, in order to determine whether there is a complementary or substitution relationship between the two chosen variables.

4. Results

4.1. Unit root test

Charts 1–3 presents the time series plots of LLAB, LEX and LIM in the period 2005–2021. It can be observed that the variable LIM and LEX share a similar upward trend, while the variable LLAB shows a downward trend in the opposite direction. However, it is difficult to determine whether there is a long-term equilibrium relationship between the variables through time series plots alone, so further cointegration analysis is needed. Before conducting the ADF test, autocorrelation should be tested for all-time series to ensure the accuracy of the ADF test results.

Table 2 presents the autocorrelation results of the three variables through the autocorrelation function in Gretl. Then, the lag orders (K) can be set to 1 based on the PACF. Table 3 shows the results of the ADF test using the appropriate lag order (K) in Gretl for variables LLAB, LEX, and LIM. As the Table 3 indicates, the original series of LLAB, LEX, and LIM are non-stationary time series, which implies the presence of unit roots. The ADF test on the first-order difference series of LLAB and LEX shows that both are stationary time series at the 1% test levels, respectively. Meanwhile, the first-order difference series of LIM is integrated of order 1 at the 5% test level. Therefore, LLAB, LEX, and LIM are integrated of order 1. In other words, the above variables are I(1) time series. As we know, time series with the same order of integration can be tested for cointegration. The co-integration analysis can be conducted.

4.2. Co-integration analysis

The Section 4.1 has proved that cointegration analysis can be performed. Firstly, a regression model is constructed to obtain the residual series and the relationship between the two. Table 4 shows the results of the OLS regression analysis of LLAB and LEX using Gretl.

Based on the results of Table 4, the equation of the long-term regression model on LLAB and LEX can be:

$$LEX = -0.445LLAB + 28.057. \tag{1}$$

The results of Table 5 show that the equation of the long-term regression model on LLAB and LIM is:

$$LIM = -0.67LLAB + 29.485. \tag{2}$$

As can be seen from the long-term regression model, the p-value less than 0.01 indicates that the overall model is significant at 1% test level, but the validity of the long-term regression model equation needs to be further tested. Secondly, the residual term of the regression equation needs to be tested for stationarity through the ADF test in order to examine whether the long-term regression model holds true. If the residual term is a stationary series, the above long-term regression equations hold true.

The results in Table 6 show that the p-value of the residuals saved from the equation (1) of the long-term regression model on LLAB and LEX is 0.001, which is lower than 0.01. Similarly, the p-value of the residuals saved from the equation (2) of the long-term regression model on LLAB and LIM is 0.002, which is also lower than 0.01. This indicates that both sets of residuals are stationary series at the 1% test level. Thus, it can be concluded that a co-integration relationship exists not only between LLAB and LEX but also between LLAB and LIM. The long-term regression model equations established in the Section 4.2 hold true, suggesting a stable and long-term equilibrium relationship between the number of people sent by China to the EU for labour cooperation and the value of bilateral merchandise trade (import and export) between China and the EU.

The interpretation for the equation (1) of the long-term regression model on LLAB and LEX is as follows: In the long run, every 1 unit increase in LLAB causes an average decrease in LEX of 0.445 percentage points, or every 1 unit increase in LEX causes an average decrease in LLAB of 2.247 (1/–0.445) percentage points.

As for the explanation of the equation (2) of the long-term regression model on LLAB and LIM, it means that in the long run, every 1 unit increase in LLAB causes an average decrease in LIM of 0.67 percentage points, or every 1 unit increase in LIM causes an average decrease in LLAB of 1.492 (1/–0.67) percentage points. In other words, for every 1% increase in the value of import between China and the EU, the number of people sent by China to the EU for labour cooperation decreased by 1.492% (1/–0.67).

4.3. Error correction model (ECM)

The Section 4.3 focuses on analyzing the short-term dynamics of the equilibrium relationship between variables using an error correction model, which builds upon the long-run model derived in the Section 4.2 The short-run model enables the examination of fluctuations in the equilibrium relationship between variables that may deviate from the long-run model due to other factors.

Table 7 provides the coefficients of the error correction models for LLAB and LEX, as well as LLAB and LIM, respectively.

The results show that the LLAB is related to the LEX error correction model by:

$$\Delta LEX = 0.048\Delta LLAB - \\ -0.332 ECM(-1) + 0.077. \quad (3)$$

LLAB is related to the LIM error correction model by:

$$\Delta LIM = 0.005\Delta LLAB - \\ -0.155 ECM(-1) + 0.088. \quad (4)$$

The error correction term coefficients of –0.332 and –0.155, respectively, indicate a negative value, which signifies the convergence of the short-term dynamics with the long-term model. In other words, these coefficients reflect the strength of the error correction model's correction mechanism for deviations from the long-run equilibrium.

4.4. Granger causality analysis

Although the cointegration relationships between LLAB and LEX, and LLAB and LIM were found in the Section's 4.2 cointegration analysis, the direction of influence between the variables was not determined. To clarify their causal relationship and establish the independent and dependent variables, the Granger causality test was conducted. It is important to note that the Granger causality test assumes series stationarity, and in this case, the variables are all first-order differences. The lag order for the Granger causality test was determined using the lag order selection function in the econometric software. The results of the test at the appropriate lag order are presented in Table 8.

As shown in the results, a two-way causal relationship between ΔLLAB and ΔLEX is observed when the lag order is set to 3, with each variable being the Granger cause of the other. However, when the lag order is set to 1, a unidirectional causal relationship is found, with ΔLIM being the Granger cause of ΔLLAB, while ΔLLAB is not the Granger cause of ΔLIM.

After determining the direction of influence between the variables, and combining it with the co-integration analysis in the Section 4.2, it was observed that for every 1% increase in the export merchandise trade value from China to the EU, the number of people sent by China to the EU for labour cooperation decreased by 2.247% (1/−0.445), and for every 1% increase in the number of people sent by China to the EU for labour cooperation, the value of export trade between China and the EU decreased by 0.445%. Similarly, in the case of import trade, for every 1% increase in the value of imports between China and the EU, the number of people sent by China to the EU for labour cooperation decreased by 1.492% (1/−0.67).

5. Conclusion

The scientific aim of this paper is to explore the link between the movement of labour factors and international trade between China and the EU. Based on data from 2005 to 2021, the relationship between China's dispatched labour, a particular form of factor mobility, and trade in goods is examined through co-integration analysis and Granger causality tests.

The hypothesis of this paper is that there exists a substitution between labour mobility and international trade in the case of China and the EU.

The obvious conclusion that can be drawn from the empirical part is that there is a long-run stable cointegration relationship between the number of people sent from China to the EU and import and export trade. Moreover, an increase in China's trade with the EU leads to a decrease in the number of Chinese people sent to the EU, i.e. the two are substitutes for each other and the hypothesis of this paper is not rejected. In addition, the Granger causality test finds that Chinese dispatched labour flows to the EU are the Granger cause of export trade and vice versa. China's dispatched labour flow to the EU is not a Granger cause of import trade while the China-EU import trade is a Granger cause of China's dispatched labour to the EU. This is shown by the fact that for every additional unit of labour sent by China to the EU, China's exports to the EU decrease by 0.445% (for every 1% more of China's trade exports to the EU, China's dispatched labour flows to the EU decrease by 2.247%). For every 1% increase in China's trade imports from the EU, China's dispatched labour flow to the EU decreases by 1.492%.

It should be noted that the empirical analysis in this elaboration covers the period from 2005 to 2021, which is relatively short and may affect the accuracy of the results to a certain extent. Additionally, there are limitations in the study of the relationship between labour flows and international trade, as only some of the labour factors flowing into the EU have been analyzed, and spontaneous migration and immigration from China to the EU have not been considered. Moreover, the analysis of labour mobility did not take into account the possible influence of political factors. Finally, the relationship between labour mobility and international trade has important implications not only for the global economy but also for the future development of national immigration and trade policies. Further comprehensive research is needed in this field.

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Appendix

Table 1.
The data of empirical analysis, 2005—2021

Years	The number of people sent by China to the EU for labour cooperation (LAB)	The export from China to the EU in USD (EX)	The import from the EU to China in USD (IM)
2005	10059	14371158000	7359542000
2006	11326	18198335000	9031898000
2007	11668	24519172900	11095951100
2008	12951	29287819900	13269949600
2009	10047	23628419000	12775751000
2010	11074	31123542300	16847712800
2011	5290	35601983000	21119300000
2012	4251	33398845000	21205485000
2013	3899	33898502000	22005530000
2014	3633	37088434000	24425486000
2015	3814	35587590000	20887894000
2016	4336	33904794000	20797000000
2017	6464	37204153000	24487422000
2018	5312	40863164000	27353260000
2019	6048	42851427000	27659551000
2020	2974	39097800000	25855100000
2021	4022	51824700000	30986500000

Source: Own preparation based on MOFCOM (2023) and National Bureau of Statistics of China (2022).

Table 2.
Autocorrelation function for LLAB, LEX and LIM

Variables	LAG	ACF	PACF	Q-stat.	p-value
LLAB	1	0.749***	0.749***	11.315	0.001
	2	0.523***	−0.085	17.204	0.000
	3	0.249	−0.256	18.639	0.000
LEX	1	0.597***	0.597***	7.197	0.007
	2	0.375	0.029	10.226	0.006
	3	0.288	0.082	12.134	0.007
LLM	1	0.740***	0.740***	11.041	0.001
	2	0.537***	−0.022	14.246	0.000
	3	0.373	−0.036	20.456	0.000

Note:
***, **, * indicate significant at the 1%, 5% and 10% level.

Source: Own preparation.

Table 3.
The results of ADF analysis for LLAB, LEX and LIM

Variables	(c,t,k)	ADF statistics	p-value	Conclusion
LLAB	(c,0,1)	−1.312	0.626	nonstationary
ΔLLAB	(c,0,1)	−4.594	0.000***	stationary
LEX	(c,0,1)	−2.457	0.126	nonstationary
ΔLEX	(c,0,1)	−3.989	0.001***	stationary
LIM	(c,0,1)	−2.460	0.126	nonstationary
ΔLIM	(c,0,1)	−4.457	0.011**	stationary

Note:
Δ denotes the first difference; (c,t,k) indicates the constant term, the trend term and the lag orders; ***, **, * indicate significant at the 1%, 5% and 10% level.

Source: Own preparation.

Table 4.
Regression results of LLAB and LEX

Variables	Coefficient	S.E.	t-ratio	p-value
const	28.057	1.049	26.730	0.000***
LLAB	−0.445	0.124	−3.678	0.003***
mean dependent var	27.179		S.D. dependent var	0.318
sum squared resid	0.853		S.E. of regression	0.238
R-squared	0.474		adjusted R-squared	0.439
F(1, 14)	12.771		p-value(F)	0.002
log-likelihood	1.309		Akaike criterion	1.380
Schwarz criterion	3.047		Hannan–Quinn	1.546
rho	0.234		Durbin–Watson	1.091

Note:
***, **, * indicate significant at the 1%, 5% and 10% level.

Source: Own preparation.

Table 5.
Regression results of LLAB and LIM

Variables	Coefficient	S.E.	t-ratio	p-value
const	29.485	1.107	26.650	0.000***
LLAB	−0.670	0.131	−5.118	0.000***
mean dependent var	23.637		S.D. dependent var	0.420
sum squared resid	1.075		S.E. of regression	0.268
R-squared	0.619		adjusted R-squared	0.594
F(1, 14)	26.189		p-value(F)	0.000
Log-likelihood	−0.652		Akaike criterion	5.305
Schwarz criterion	6.971		Hannan–Quinn	5.470
rho	0.313		Durbin–Watson	1.033

Note:
***, **, * indicate significant at the 1%, 5% and 10% level.

Source: Own preparation.

Table 6.
ADF test results of residuals

Variables	(c,t,k)	ADF statistics	p-value	Conclusion
residuals-1	(0,0,0)	−3.715	0.001***	stationary
residuals-2	(0,0,0)	−3.383	0.002***	stationary

Note:
***, **, * indicate significant at the 1%, 5% and 10% level.

Source: Own preparation.

Table 7.
The test results of the error correction model

Variables	coefficient	S.E.	t-ratio	p-value
const	0.077	0.031	2.505	0.026**
Δ_LLAB	0.048	0.099	0.487	0.634
$ECM_1(-1)$	−0.332	0.088	−3.793	0.002***
const	0.088	0.029	2.981	0.011**
Δ_LLAB	0.005	0.099	0.049	0.961
$ECM_2(-1)$	−0.155	0.065	−2.380	0.033**

Note:
Δ denotes the first difference; ***, **, * indicate significant at the 1%, 5% and 10% level.

Source: Own preparation.

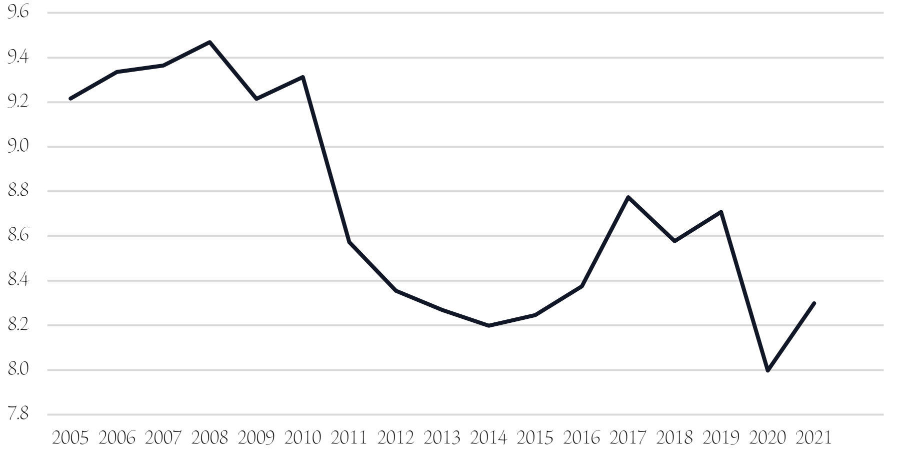
Table 8.
Results of Granger causality test of ΔLLAB and ΔLEX, ΔLLAB and ΔLIM

Lag intervals	H0	F-statistics	p-value	Results
3	ΔLLAB is not Granger cause for ΔLEX	21.251	0.000***	reject H0
	ΔLEX is not Granger cause for ΔLLAB	4.465	0.046**	reject H0
1	ΔLLAB is not Granger cause for ΔLIM	0.048	0.953	do not reject H0
	ΔLIM is not Granger cause for ΔLLAB	3.126	0.081*	reject H0

Note:
Δ denotes the first difference. ***, **, * indicate significant at the 1%, 5% and 10% level.

Source: Own preparation.

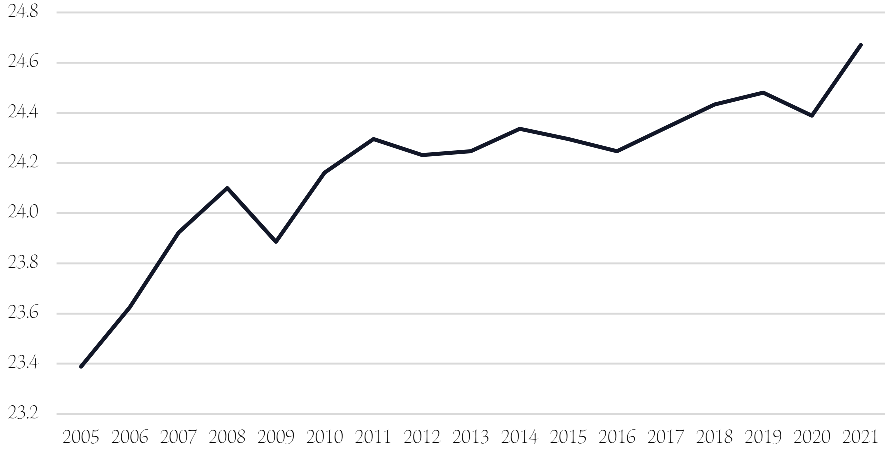
Chart 1.
The time series plots of the LLAB



Note:
Here the horizontal coordinates represent the year and the vertical coordinates represent the logarithmic value of the variables LAB.

Source: Own preparation.

Chart 2.
The time series plots of the LEX



Note:
Here the horizontal coordinates represent the year and the vertical coordinates represent the logarithmic value of the variables EX.

Source: Own preparation.

Chart 3.
The time series plots of the LIM

Note:
Here the horizontal coordinates represent the year and the vertical coordinates represent the logarithmic value of the variables IM.

Source: Own preparation.