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1. Introduction

Since the initiation of the Global Europe strategy, which set out a new agenda reflecting European strategic priorities in trade, the EU has launched Free Trade Agreement (FTA) negotiations with various Asian countries in an attempt to address barriers to EU exports. The removal of both tariff and non-tariff barriers in these so-called 'new generation' agreements helps to open up new markets for European exporters and to increase European competitiveness. The recent finalization of the EU-Korea FTA demonstrates a good example of such FTA, in which the EU prioritizes a partner with a large and growing market with high initial protection. There are currently many other FTAs under negotiation with countries that fulfill one of these criteria.[1] In this context, one can question as to why Taiwan is not on the list and whether it is because of certain geopolitical obstacles or because this Asian economic powerhouse is deemed as not fitting the set criteria.

Taiwan is the 5th largest economy in Asia after Japan, China, India and South Korea; it is the world 18th largest trading economy, 6th most competitive economy globally in overall competitiveness[2] and 3th best investment environment in the world. [3] However, as a result of tense cross-strait relations and growing economic importance of China in the region, Taiwanese economy found itself in some degree of isolation, while essentially all other Asian countries are currently undertaking steps towards economic integration. Given that Taiwan is not recognized as a sovereign state by its main trading partners, the situation is very complicated and the overall circumstances do not favor deeper economic ties with neighboring states.

Taiwan attempts to further integrate its economy with China and the rest of the world in order to establish grounds for deeper cooperation with other countries in the region. In 2010 Taiwan and mainland China negotiated an Economic Cooperation Framework Agreement (ECFA), aiming to build an important economic link that would not only normalize the cross-straits economic relations, but would also set a founding stone for future FTAs with other key partners in Asia and particularly with the EU. However, a potential FTA with Taiwan is a very sensitive issue as there is a widespread belief that such a move would upset the EU's political and economic relations with China. However, based on the European criteria for its FTA partners, Taiwan should be somewhere at the top on the EU agenda. Even though the Taiwanese economy is smaller compared to Korea or India, Taiwan fulfills the criteria of market size if the strategic triangular relationship EU-China-Taiwan and the effects of access to the vast Chinese market are taken into account. Taiwan has currently very low initial tariff barriers, but the non-tariff barriers provide a powerful reason for the continuation of discussions on possible trade enhancement.

[1] EU-Singapore FTA, EU-Malaysia, EU- India FTA, EU-ASEAN FTA, EU-Vietnam FTA

[2] World Competitiveness Yearbook (2011), International Institute for Management Development (IMD)

[3] Investment Environment Risk Assessment Report (2010), Business Environment Risk Intelligence (BERI)

As this paper confirms, the EU-Taiwan FTA would be beneficial for both parties as well as the Czech Republic. The EU should support this initiative because the FTA would bring many positive effects for European exports. Moreover, this European step would contribute to the creation of a special triangular relationship between the EU, China and Taiwan, assuming that that trade liberalization between EU and Taiwan will interact positively with trade liberalization between Taiwan and China.

This study focuses on some concrete implications that the EU-Taiwan FTA would have for the Czech economy. It analyzes patterns of mutual trade and the implications of the ECFA provisions. Even though the current trade exchange is very modest (imports represent less than 1% of overall imports and exports are even smaller), there is an untapped potential in the Czech-Taiwanese relations that could be established through trade liberalization. Taiwanese investments in the Czech Republic play very significant role, as they rank fourth among investors in terms of job creation capacity. The proposed trade liberalization is extremely unlikely to influence Czech economy negatively, the most likely result are small positive effects especially for export oriented industries which will profit from higher indirect exports of Czech products via other EU countries (esp. Germany). If we also take into effect possible learning effects, the trade liberalization definitively constitutes an opportunity to improve the welfare of the Czech Republic and diversification of Czech exports.

2. The Czech Republic-Taiwan Trade Relations: General Features

This chapter aims at analyzing and discussing the contents of the CZ-Taiwan trade relations. Unless specified otherwise, this part is based on data on trade flows provided by the Czech Statistical Office. It is important to emphasize that data on trade between the Czech and non-EU countries are often plagued by inconsistencies caused by imperfect disentangling of intra-European trade flows of goods originating in third countries (the so-called "Rotterdam effect").[4] Relevance of this issue for aggregate trade data is analyzed in appendix I where data from Taiwanese (Bureau of Foreign Trade), European (Eurostat – COMEXT) and Czech (CSU – Stazo) sources are compared, significant discrepancies are identified, and a less orthodox attempt to estimate the true trade deficit between Czech Republic and Taiwan is presented. It should be noted that the extreme extent of the inconsistencies in official data decreases the reliability of our estimates. A detailed revision and analysis of mutual trade flows would therefore be a useful first step on the path to further trade liberalization.

The first section presents an overview of trade in goods and services between the Czech Republic and Taiwan. It also summarizes and discusses the patterns of the CZ-Taiwan trade relations, particularly focusing on the most important industries for the mutual trade and their competitive edge in the overall world trade. The second section analyzes the recent EU-Taiwan trade policies with regard to tariff and non-tariff barriers. The Taiwanese investment position is described in the last section with emphasis on Taiwanese investment activities in the Czech Republic.

a. Trade Patterns

A general overview of the trade relationship in goods between the Czech Republic and Taiwan is presented in Figure 1 and Table 1. Starting in 2006, the figures illustrate trends in imports, exports, and trade balance over the last five years. Figure 1 clearly demonstrates Czech Republic's trade deficit (in goods) with Taiwan during this period. In spite of the fact that the deficit was lower in 2008 and 2009 than in the previous years, it rose by 12 % and reached its initial levels in 2010 again. Taiwanese-Czech trade in services does not follow any stable pattern. There was a significant increase in Czech exports of services to Taiwan from 2006 to 2007, then a fall in 2007, and then a significant increase compared to 2007-level between 2008 to 2009 and throughout year 2010. However, the total Czech exports in services were changing in the period, which means that, in relative terms, Taiwanese import of Czech services reached the highest level in 2009 when it accounted for 0.22% of total exports of services. On the contrary, imports of Taiwanese services were following a rising trend over the period, although the amount dropped by a factor of three in 2010 when compared to 2009.

[4] See e.g. Herrigan et al. (2005) for details on this issue.

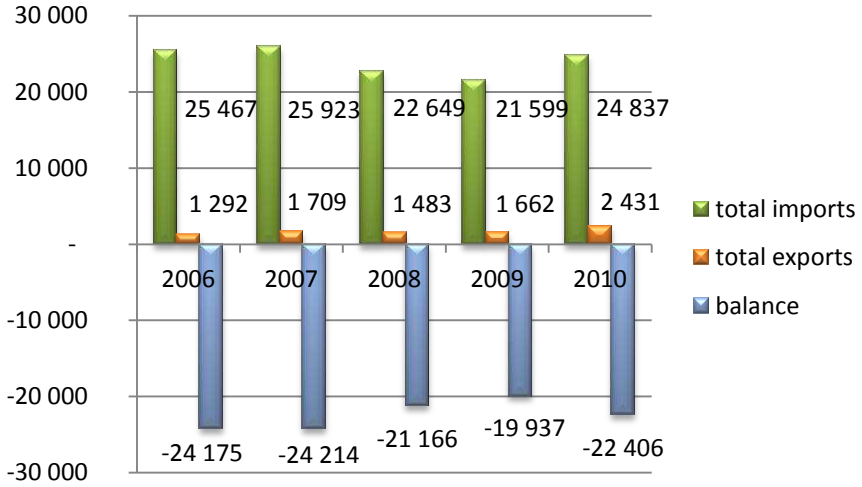
Table 1: Exports and Imports between the Czech Republic and Taiwan (mil., CZK)

	2006	2007	2008	2009	2010
Imports of goods	25 443	25 136	21 926	17 759	23 823
Import of services	25	787	723	3 840	1 015
Exports of goods	1261	1489	1324	1118	1966
Export of services	31	220	159	544	466

Source: Czech Statistical Office (2011)

As Figure 1 illustrates, while from 2006 to 2010, Czech exports to Taiwan followed a relatively stable and steady path, year 2010 was marked by a slight increase in exports. By contrast, Taiwanese imports were characterized by a higher level of volatility. Whereas the imports accounted for more than 25 000 million of CZK between 2006 and 2007, year 2007 started off a gradual fall having reached its bottom in 2009. It might be assumed that the bottom coincided with the sudden exacerbation of the economic situation and with the ensuing global economic crisis at that time. Nevertheless, since 2009 imports have been on the rise again, briskly approaching the 2006-2007 levels.

Figure 1: Czech trade in goods and services with Taiwan (mil., CZK)



Source: Czech Statistical Office (2011)

A geographical breakdown of Czech Republic's trading partners can be found in Table 2. The table provides an overview of five biggest importers and five biggest export markets. Afterwards, it lists the positions of selected Asian trade partners. We can see that Taiwan

holds a lower position on the list. As to other East Asian economies, Vietnam is the 28th most important import partner, followed by India on the 33th position. Czech exporters are often discouraged from entering these markets, given the competitive nature and geographical distance of the so-called Asian tigers. On the export side, the hub for Czech exports is Hong Kong that ranks the 40th place,, followed by South Korea (44th) and Singapore (58th) and Vietnam (71th).

Table 2: Czech Republic's geographical breakdown of trade in goods (% of total trade, 2010)

	Import partners			Export partners	
1	Russian Federation	18,08 %	1	Germany	31,22 %
2	Germany	17,15 %	2	Slovakia	8,49 %
3	Poland	11,25 %	3	Poland	6,33 %
4	Slovakia	9,36 %	4	France	5,38 %
5	Azerbaijan	6,95 %	5	United Kingdom	5,03 %
28	Vietnam	0,34 %	40	Hong Kong	0,26 %
33	India	0,22 %	44	South Korea	0,18 %
38	Thailand	0,19 %	58	Singapore	0,08 %
79	**Taiwan**	**0,02 %**	**60**	**Taiwan**	**0,08 %**
66	South Korea	0,05 %	61	Thailand	0,08 %
84	Sri Lanka	0,02 %	63	Malaysia	0,07 %
93	Bangladesh	0,01 %	71	Vietnam	0,05 %
102	Singapore	0,01 %	98	Afghanistan	0,02 %
121	Hong Kong	0,001 %	109	Sri Lanka	0,01 %

Source: Czech Statistical Office (2011)

Overall, Czech trade is geographically focused on the country's neighbors and other major EU countries. Moreover, the Russian federation5 and Azerbaijan play an important role in the Czech trade structure. As a matter of fact, Russia accounts for 18% of imports, and Germany for a third of exports and roughly 17% of imports.

Breakdown of exports and imports by product category (HS2) is provided in Table 3 and Table 4. As we can see, the Czech exports to Taiwan are dominated by two groups of goods – nuclear reactor, boilers, and machinery along with electrical machinery and equipment – both covering roughly 20% of the exports. The third position is occupied by vehicles other

[5] Value of imports from Russia and therefore also the ranking of Russia among import partners fluctuate with the prices of crude oil and natural gas, and with the development of EUR/USD exchange rate.

than railway and tramway, accounting for a tenth of the total exports. Similarly, Czech imports from Taiwan are dominated by the very same categories that account for about 83% of all the imports from Taiwan.

Table 3: Main Czech Exports toTaiwan at HS 2 level (averaged 2008-2010)

	Group	Industry	% of Exports
1	84	Nuclear reactors, boilers, machinery/mechanical appliances	19,32 %
2	85	Electrical machinery and equipment	18,81 %
3	87	Vehicles other than railway/tramway	10,07 %
4	70	Glass and glassware	6,24 %
5	90	Optical, photographic, medical devices	5,72 %
6	95	Toys, games, sports requisites	5,67 %
7	40	Articles of rubber	4,89 %
8	73	Articles of iron or steel	3,16 %
9	28	Organic chemicals	3,14 %
10	39	Plastics	2,92 %
		Others	20,06 %

Source: Czech Statistical Office (2011)

Table 4: Main Taiwanese Exports to the Czech Republic at HS 2 level (averaged 2008-2010)

	Group	Industry	% of Imports
1	87	Vehicles other than railway/tramway	32,95 %
2	84	Nuclear reactors, boilers, machinery/mechanical appliances	30,53 %
3	85	Electrical machinery and equipment	20,17 %
4	90	Optical, photographic, medical devices	2,74 %
5	73	Articles of iron or steel	2,25 %
6	95	Toys, games, sports requisites	1,64 %
7	39	Plastics	1,49 %
8	82	Tools, implements, cutlery, spoons and forks	1,28 %
9	76	Aluminium and articles thereof	1,06 %
10	94	Furniture; bedding, mattresses, mattress supports, cushions	0,73 %
		Others	5,17 %

Source: Czech Statistical Office (2011)

Tables 5 and 6 (HS6) present a more detailed overview of the structure of Czech-Taiwanese trade. Czech exports to Taiwan are not strictly dominated by a single category, but top ten categories are rather equally distributed within the range of the export share from about 7% to 2.5%. The first category of goods, which is exported, is automotive engines (6.77%). Other electrical generating sets and rotary converters along with tricycles, scooters, and pedal cars account for roughly 4% of total exports each. Remaining positions are basically occupied by automobile-related industries. Almost 66% of total exports are dispersed throughout other categories.

Table 5: Main Czech Exports to Taiwan at HS 6 level (averaged 2008-2010)

	Group	Industry	% of exports
1	870322	Automobiles w reciprocit. piston engine displac. > 1000 cc to 1500 cc	6,77 %
2	850239	Other electrical generating sets and rotary converters	4,39 %
3	950300	Tricycles,scooters,pedal cars;dolls carriages	4,23 %
4	847330	Parts&accessories of automatic data processg machines	3,11 %
5	700232	Tubes of linear glass	3,09 %
6	401110	Pneumatic tire f motor car incl station wagons&racg cars	2,73 %
7	870323	Automobiles w reciprocit. piston engine displac. > 1500 cc to 3000 cc	2,68 %
8	870332	Automobiles with diesel engine displac. more than 1500 cc to 2500 cc	2,61 %
9	846021	Grinding machines in which pos of 1 axis to an acc to 0.01mm n/c	2,54 %
10	901210	Microscopes other than optical microscopes and diffraction apparatus	2,22 %
		Others	65,63 %

Source: Czech Statistical Office (2011)

On the Czech import side, automatic data processing constitutes the main import category (13.3%). It includes a diversified set of products, mainly automotive parts and accessories. Telephones for cellular and other wireless networks and machinery parts and applications account for the second biggest Taiwanese export group (about 7% each). The third biggest group corresponding to roughly 5% of Taiwanese exports each is formed by processors and controllers, and bicycles, tricycles and other cycles. 4% of total Czech imports from Taiwan are represented by optical devices, appliances and instruments, photosensitive devices, storage devices, and portable automatic data-processing machines. In contrast to Czech exports to Taiwan, top ten import categories account for approximately 66% of total imports, leaving only 44% for the other categories. Thus, the import structure is less diversified than the export side.

Table 6: Main Taiwanese Exports to the Czech Republic at HS 6 level (averaged 2008-2010)

	Group	Industry	% of imports
1	847330	Parts&accessories of automatic data processg machines	13,03 %
2	851712	Telephones for cellular networks or for other wireless networks	7,35 %
3	852990	Parts suitable f use solely/princ w the app of headings 85.25 to 85.28	7,19 %
4	854231	Processors and controllers	5,33 %
5	871200	Bicycles and other cycles (including delivery tricycles),not motorised	4,81 %
6	901380	Optical devices, appliances and instruments	3,86 %
7	854140	Photosensitive semiconduct device,photovoltaic cells&light emit diodes	3,86 %
8	852351	Solid state non-volatile semiconductor storage devices	3,73 %
9	847130	Portable automatic data-processing machines,< 10 kg	3,73 %
10	851762	Machines for transmission/regeneration of voice,data	2,58 %
		Others	44,55 %

Source: Czech Statistical Office

b. Problems with Indirect Exports

There is ample anecdotic evidence suggesting that Czech trade relations with Asian countries are rather indirect. It seems that a significant proportion of imports end up being used as inputs for Czech production which is subsequently exported to EU countries; vice versa, many Czech companies produce and export products which eventually (after further processing) enter Asian markets as mostly German imports. Unfortunately, as far as we know there has not been any sufficiently detailed research that would generate sufficiently precise data on the empirical relevance of this type of trade. We only have indirect statistical evidence based on discrepancies in trade statistics (see Appendix I for more details) and data on the use of imported inputs for further production based on national input-output tables.[6] We therefore attempted to design and apply a new method of analyzing this kind of flows based on input-output methodology. As far as we know, it is a first such attempt in empirical literature on trade with Asian countries. Caveat emptor applies here fully – the presented data are macroeconomic estimates and there is no direct way how to test their statistical significance and reliability. The methodology used for the estimates is described in Appendix I.

There are four types of the indirect flows that we estimated: direct re-exports of Czech products via Germany to Taiwan (re-exports without significant processing), embodied exports (Czech inputs used in German exports to Taiwan), direct re-exports of Taiwanese

[6] However, these only contain information on total flows, i.e. with the breakdown according to the source countries.

products originally imported to the Czech market, and embodied exports (inputs from Taiwan used in Czech exports). The first two types of flows are relevant for the total value of Czech exports to Taiwan, the latter two for estimation of the "real" Czech imports from Taiwan. We assume that neither "circular" trade nor inward/outward processing plays an important role in mutual trade relations; when analyzing Czech exports we focused on the role of Germany. The results are presented in the following table:

Table 7 - Estimates of Indirect Flows between the CR and Taiwan

Mil. EUR	**Imports**
Official imports in 2007 according to Eurostat	505.1
Estimated direct re-exports of imports from TW to EU 27	0.5
TW inputs in Czech exports to EU 27	166.0
Estimated total imports:	338.7
	Exports
Official exports in 2007 according to Eurostat	53.71
Estimated direct reexports via Germany	29.09
Czech inputs in German exports to Taiwan	35.58
Estimated total exports:	118.4
	Balance
Official balance in 2007 according to Eurostat	451.4
"Corrected" for reexports and "embodied reexports"	220.3

Our estimates suggest that the role of the flow is rather important. It seems that the true trade deficit of the Czech Republic with Taiwan is actually 50% lower than the deficit which appears in the data published by Eurostat. The results also very strongly suggest that import liberalization may have fairly complex effects on Czech economy: on the one hand, cheaper inputs may support further Czech export expansion on European markets; on the other hand, the need for assembly and processing operations undertaken on Czech territory may be diminished by the liberalization. Table 8 identifies the sectors where these two effects can play the most important role.

Table 8 - Share of Inputs used for Further Exports in Total Imports from Taiwan

Products (CPA)	Imports from Taiwan, mil. EUR	Estimated reexports of imported inputs, mil. EUR	Share of reexports in imports (%)
Textiles	4.8	2.8	58.5
Electrical machinery and apparatus n.e.c.	30.2	14.1	46.7
Rubber and plastic products	7.1	3.3	46.3
Fabricated metal products, except machinery and equipment	15.6	6.8	43.8
Basic metals	9.2	3.9	42.9
Radio, television and communication equipment and apparatus	144.4	61.7	42.7
Pulp, paper and paper products	0.8	0.3	39.5
Leather and leather products	0.4	0.2	39.4
Wearing apparel; furs	0.5	0.2	39.0
Chemicals, chemical products and man-made fibres	90.4	30.3	33.5
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	0.2	0.1	32.2
Coke, refined petroleum products and nuclear fuels	0.1	0.0	30.0
Motor vehicles, trailers and semi-trailers	6.7	1.8	27.1
Office machinery and computers	91.5	24.6	26.9
Printed matter and recorded media	1.0	0.2	24.1
Medical, precision and optical instruments, watches and clocks	5.3	1.2	22.8
Machinery and equipment n.e.c.	52.6	9.3	17.8
Other non-metallic mineral products	1.4	0.2	16.8
Products of agriculture, hunting and related services	0.0	0.0	14.9
Furniture; other manufactured goods n.e.c.	13.3	1.7	13.0
Food products and beverages	1.2	0.1	7.9
Fish and other fishing products; services incidental of fishing	0.3	0.0	7.8
Other transport equipment	27.3	1.6	5.8
Recreational, cultural and sporting services	0.1	0.0	0.1

c. Overview of EU and Taiwanese Trade Policies

In order to understand the general trading environment, within which the discussion of a possible FTA is to take place, this section aims to outline the existing levels of import protection across all sectors for trade between Taiwan and the EU.

Table 9 provides a comparison of tariffs in the EU, Taiwan and Korea. The example of Korean tariffs is presented here because of the recent conclusion of the EU-Korea FTA that can be considered as a "how to do it" model for the EU-negotiated FTAs with its Asian counterparts. Korea also demonstrates an example of high initial tariff levels. Several conclusions can be drawn from this table. Firstly, both the EU and Taiwan have bound 100% of its tariffs lines when compared to Korea. Secondly, average tariffs already remain very low compared to Korea, particularly when it comes to tariffs on agricultural imports that are about 3 times higher in Korea than in the EU and Taiwan.

Table 9: Comparison of basic indicators of tariff protection in the EU, Taiwan and Korea (%, 2009)

Economy	EU	Taiwan	Korea
Tariff binding coverage %	100	100	94,6
Simple average Final Bound	5,2	6,4	16,6
Simple average MFN applied manufacturing	4	4,5	6,6
Simple average MFN applied agriculture	13,5	16,6	48,6
Simple Average MFN Applied Tariff all goods	5,3	6,1	12,1
Trade weighted average (2008/2009)	2,9	1,9	8,3
Non ad-valorem duties (% total tariff lines)	4,6	1,1	0,4

Source: International Trade Centre

The overall structure of trade protection is very similar both in the case of the EU and Taiwan. Lowest tariffs are on primary and manufactured goods, while the highest level of protection is for agricultural products. The figures in Table 9 show that the difference in general level of protection is not significant. The average import protection for European and Taiwanese agriculture is about 10% and it is approximately 3% for manufactured and industrial goods. The fact that the tariffs are already considerably low, suggests that effects of tariff reduction within trade liberalization between the EU-Taiwan will not be as significant as the results of the EU-Korea FTA. Nevertheless, even though the Taiwanese tariffs are generally low, there are peaks on products that are important for European/Czech exports to Taiwan. The peak tariffs are in the bold lines in Table 10. The benefits from the EU-Taiwan FTA would be significant particularly for the automotive industry that faces one of the peak tariffs (15,7 %). Compared to the EU-Korea FTA, the situation was completely opposite, because the decrease in tariffs in the automotive industry was on the EU side and

therefore affected more significantly the European car producers. As Taiwan does not manufacture any global car brand, lower tariffs and abolition of non-tariff barriers in the EU-Taiwan trade would constitute a comparative advantage for European car producers. "The removal of tariffs and non-tariff barriers changes relative prices in the Taiwanese market – without the current barriers, European cars will become cheaper, while cars assembled in Taiwan (i.e. by Japanese manufactures) will not. This will induce more trade and Taiwanese will buy more European cars." (Martin H. Thelle, 2008) Also products from glass belong to the top ten products that are part of Czech exports to many countries and these products face relatively high tariff (7,3 %) on Taiwanese market.

Table 10: Bilateral import protection levels per sector (2009)

Product Description	Protection on import from Taiwan	Protection on imports from EU
Live animals animal products	21,60 %	15,66 %
Vegetable products	8,01 %	21,21 %
Animal or vegetable fats and oils, animal or vegetable waxes	10,07 %	4,02 %
Prepared foodstuffs, beverages, spirits, vinegar, tobacco	15,68 %	14,98 %
Mineral products	0,54 %	0,36 %
Products of the chemical or allied industries	3,02 %	1,99 %
Plastic and rubber articles	5,13 %	4,25 %
Raw hides and skins, leather, fur skins, saddlery, travel goods, handbags	4,14 %	5,24 %
Wood and articles of wood, cork	1,95 %	1,65 %
Pulp of wood, paper, paperboard	0,00 %	0,00 %
Textiles and textile articles	9,83 %	9,58 %
Footwear, headgear, umbrellas, feathers, artificial flowers	9,47 %	5,35 %
Articles of stone, plaster, cement, ceramic products, glass and glassware	**3,94 %**	**7,27 %**
Natural or cultured pearls, precious or semi-precious stones, metals	0,41 %	0,03 %
Base metals and articles of base metal	1,76 %	1,63 %
Machinery and mechanical appliances, electrical equipment	**1,67 %**	**1,99 %**
Vehicles, aircraft, vessels and associated transport equipment	**7,17 %**	**15,68 %**
Optical, photographic, cinematographic, medical or surgical instruments	**1,33 %**	**1,75 %**
Arms and ammunition	2,32 %	1,62 %
Miscellaneous manufactured articles	1,45 %	1,51 %
Art and Antibes	0,00 %	0,00 %
Agricultural Products	9.98%	10.49%
Harmonized System	3.51%	4.13%
Industrial Products	2.86%	3.34%

Source: International Trade Centre

Non-tariff issues and barriers in services constitute main concern for European exporters. Non-tariff barriers (NTBs) can be considered a common headache for exporters dealing with

the diverse Asian markets. NTBs in manufacturing affect Czech/European exports more than tariff protection. It influences particularly the exports of electronics, automobiles, chemicals and pharmaceuticals. Main problem lies in the official norms that usually diverge from international norms, because Taiwan is very often excluded from international standard-setting bodies. Additionally, most of the certifications are not accepted in Taiwan, leading to double testing and further costs for exporters.

Figures in Table 11 were prepared from the most recent ECCT position papers. The list of NTBs is not exhaustive, but since it offers a break-down per industrial sectors, the figures describe industries, which represent a hurdle for foreign manufactures in terms of NTBs.

Table 11: Number of important issues encountered by EU firms in Taiwan

Industry	Administrative Barriers in services	Certification, Trade facilitation, Technical rules	Customs	Tax	Total
Automotive		10	1		11
Beverage Alcohol		2		4	6
Agro-chemical	1	1			2
Electrical Engineering		4	4		8
Luxury Goods	3	8	2		13
Pharmaceuticals	11				11
Other products			12		12
Retail and distribution	7	13		1	21
Financial services	20			1	21
Telecommunications	19		2		21
Insurance	15				15
Intellectual property rights	22				22
Total	**98**	**38**	**21**	**6**	**163**

Source: ECCT position papers (2010-2011)

Extensive list of NTBs applied in Taiwan is beyond the scope of this study. However, a more detailed list of the most important NTBs in the automotive industry is provided, as this industry is pivotal for Czech exports to Taiwan. The listed NTBs also illustrate characteristics of barriers that exporters to Taiwan have to face.

Automotive industry

Emission standards, testing and certification of vehicles

- ECE certificates under the United Nations Economic Commission for Europe scheme are not accepted
- Double diesel passenger cars smoke test (Directive 72/306/EEC is not accepted)
- Euro 5 emission standards - European producers are required for second smoke tests
- Diesel and petrol fuels with a sulfur content of less than 10 ppm, are not widely available at petrol stations, preventing a usage of more advanced vehicles in Taiwan
- CO2 emission standards for new vehicles

Safety approvals

- ECE and EC certificates are not accepted
- Parts homologation

Accreditation of EU test laboratories

- Accreditation restricted to specific facilities and specific personnel
- European laboratories are not accredited for some of the automotive tests
- Fuel economy standards prevent vehicles with highly efficient engine technology from entering the market

Utilization of radio spectrum frequencies for automotive safety devices

- Frequency band for advanced safety features is closed in Taiwan

d. Foreign Direct Investment: Czech Republic vs. Taiwan

The investment activity between the Czech Republic and Taiwan copies a pattern that is common for Czech economic relations with other Asian partners. The Czech Republic is not a major investor country, even compared with other CEE nations. Levels of FDI outflows are very low.

In stark contrast to Taiwan, Czech foreign direct investments in Taiwan range from very modest to almost none. According to the Czech Economic Office in Taipei, there are offices of Jablotron and Koukaam Technology[7], Czech companies that sell electro technical security equipment and surveillance devices, Czech glass producer Preciosa, a representative office of Moser, a luxury high-quality glass manufacturer, and Wilsen office, a producer of contacts lenses. Škoda Auto exports its cars after a few initial hick-ups through the company Liberty Motors Ltd[8].

The motivation of the Taiwanese companies to enter the Czech market is similar to the intentions of other Asian companies that are active in Central and Eastern Europe. The main reason lies in the Czech proximity to the western markets in combination with the country's educated and skilled labor force. However, there was one more practical reason that brought all of the Taiwanese investors to the Czech market. In 2005, a new tariff of 14 %[9] was imposed on the LCD TVs, set-up boxes and multifunctional office equipment imported from non-European countries. The tariff on components that these products consist of remained low and therefore there was a strong impetus for the Taiwanese, Korean and Chinese companies to establish their operations in Europe. Quite naturally, the Eastern and Central Europe offered the most attractive conditions in terms of production costs and revenues.
As Table 12 illustrates, Germany, Japan and USA hit the main positions on the list of foreign investors. However, the value of Taiwanese investments (478 mil. USD) ranks among the top ten investments in the Czech Republic. Taiwan is the third biggest investor after Japan and Korea. However, in terms of job creation Taiwan ranks number 4. Table 13 shows the break-down of investments according to the main companies, showing that most of the investments were flowing into ICT and electronics industry.

[7] http://www.koukaam.se/koukaam.php
[8] http://www.mpo.cz/dokument67011.html
[9] http://www.ecipe.org/publications/ecipe-working-papers/trade-in-information-technology-goods-adapting-the-itata-to-21st-century-technological-change/PDF

Table 12: Characteristics of main investors' activities in the Czech Republic

Country	Number of projects	Investment (mil.CZK)	Investment (mil. USD)	New job openings
Germany	241,5	167960,46	6210,47	44505
Japan	97,5	97570,02	3178,12	24782
USA	146	53602,11	2105,77	27682
Belgium, Luxembourg, Netherlands	77	46614,50	1844,06	12651
Korea	16	45816,32	1867,64	8202
Austria, Switzerland	65,5	33285,93	1356,07	6516
France	34,5	30026,21	1051,01	7925
Italy, Cyprus, Spain	55	23389,75	947,45	6173
Ireland, United Kingdom	82,5	23310,99	843,12	14203
Canada, Mexico	9,5	14131,86	409,78	4048
Denmark, Finland, Sweden, Norway	31,5	13416,25	543,78	5256
Taiwan	**24**	**11594,96**	**478,29**	**17912**
Poland, Slovakia, Russia	8	3279,72	181,87	585
China, India	11	3241,27	148,72	2697

Source: Czech Invest

Table 13: FDI break down per investor and sector

Investor	Industry	Investment (mil. CZK)	Investment (mil. USD)	New jobs creation	Year
Hualon	Other	628,58	22,50	650	1995
FIC	Electronics	523,00	13,90	1300	2002
Asus TeK Computer	Electronics	71,10	2,35	150	2003
Hon Hai Precision Industry (Foxconn)	Maintenance Centre	99,00	3,27	318	2003
Asus TeK Computer	Electronics	648,00	25,18	1300	2004
Tatung	Electronics	141,52	5,50	300	2004
Inventec	ICT	100,00	4,45	n.s.	2005
ACER Computer	ICT	30,90	1,37	112	2005
GigaByte Technology	Maint. centre	25,00	1,11	50	2005
BenQ	Electronics	238,40	10,60	280	2005
Wistron InfoComm	Electronics	n.s.	n.s.	1200	2009
Gemtek+CZ,+s.r.o.	Electronics	75,50	4,39	200	2009
AU OPTRONICS (L) CORP.	Electronics	n.s.	n.s.	150	2010

Source: Czech Invest

Competitive conditions in many industries make Taiwan an attractive, high-value investment location and an effective 'launching pad' for further expansion to other Asian markets. It is not only an Asian tiger economy, but also one of the few liberal democracies in East Asia. It is obvious from Table 14 that even though Taiwan holds a top position in terms of friendliness to set up a business, there are also other rivals in the region that outstrip the Taiwanese rating. Particularly Korea, Japan, Thailand and Malaysia find themselves higher on the list. Looking closer at the most problematic items, Taiwan underperforms in the area of construction contract issuance, winning credit for projects, investors' protection, taxes and contracts enforcement. However, it is important to stress that the Czech Republic won significantly less favorable rating. It has to be stressed out that the lower score in the investors' protection field might be caused by difficulties that Taiwan faces in terms of sealing bilateral free trade deals and double taxation treaties.

Table 14: Regional comparison: ease of doing business rating (2011)

Economy	Ease of Doing Business	Starting Business	Construction Permits	Registering Property	Getting Credit	Protecting Investors	Paying Taxes	Trading Across Borders	Enforcing Contracts	Closing a Business
Singapore	1	4	2	15	6	2	4	1	13	2
Hong Kong	2	6	1	56	2	3	3	2	2	15
New Zealand	3	1	5	3	2	1	26	28	9	16
Australia	10	2	63	35	6	59	48	29	16	12
Korea, Rep.	16	60	22	74	15	74	49	8	5	13
Japan	18	98	44	59	15	16	112	24	19	1
Thailand	19	95	12	19	72	12	91	12	25	46
Malaysia	21	113	108	60	1	4	23	37	59	55
Taiwan	**33**	**24**	**95**	**32**	**72**	**74**	**87**	**17**	**90**	**10**
Slovak Republic	41	68	56	9	15	109	122	102	71	33
Vanuatu	60	107	21	108	72	74	19	142	76	50
Samoa	61	20	47	34	128	28	68	94	82	140
Fiji	62	104	58	50	46	44	77	103	63	117
Czech Republic	63	130	76	47	46	93	128	62	78	32
Vietnam	78	100	62	43	15	173	124	63	31	124
China	79	151	181	38	65	93	114	50	15	68

Source: Doing Business Report, World Bank

Long-term political situation constitutes one piece in the decision-making process with regards to a company's long-term investment strategy. Many consider the cross-strait relations as unstable. However, recent "Investment Environment Risk Assessment Report" issued by the US-based agency Business Environment Risk Intelligence (BERI) ranks Taiwan and Norway 3th in the world in investment environment, in case of Taiwan, it is one rank higher than in the report from the last year. The report gives Taiwan a Profit Opportunity Recommendation rating of 1B, meaning that the island is suitable for investment. BERI evaluates the world's 50 major economies on operations, political and remittance risk. "On the Political Risk Index, Taiwan placed seventh worldwide and second in Asia".[10]

Table 15: Top 10 Economies Overall Investment Environment (BERI rating 2010)

Latest rank	Economy	Rating
1	Singapore	1A
2	Switzerland	1A
3	Norway	1B
3	**Taiwan**	**1B**
4	Holland	1B
5	Austria	1B
6	Germany	1B
7	Canada	1C
8	Sweden	1C
9	Belgium	1C

Source: BERI

In contrast to Doing Business Report, Taiwan ranks 13th in the Global Competitiveness Index that is published every year by World Economic Forum. "Taiwan is situated among the top 20 economies in nine pillars, but its performance in three of them holds the economy back from its full competitiveness potential: institutions, financial market development, and labor market efficiency. The quality of the institutional framework continues to improve although by small increments, now standing at 35th position, up from 40th in 2008. Thanks to greater efficiency, Taiwan has improved by 19 positions in the financial market development pillar to 35th, a category where it used to place below the 50th mark. The third area of relative weakness is its labor market (34th), where the situation continues to

[10] http://taiwantoday.tw/ct.asp?xItem=175149&ctNode=413

deteriorate with respect to the flexibility. Given its many strengths, improvements in these areas would make Taiwan an even more competitive economy."[11]

Table 16: The Global Competitiveness Index 2010-2011

	Overall Index		Basic requirements		Efficiency enhancers		Innovation and sophistication factors	
	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Switzerland	1	5.63	2	6.5	4	5.41	2	5.71
Sweden	2	5.56	4	5.98	5	5.32	3	5.67
Singapore	3	5.48	3	6.5	1	5.49	10	5.7
United States	4	5.43	32	5.21	3	5.46	4	5.53
Germany	5	5.39	6	5.89	13	5.11	5	5.51
Japan	6	5.37	26	5.35	11	5.17	1	5.72
Finland	7	5.37	5	5.97	14	5.9	6	5.43
Netherlands	8	5.33	9	5.82	8	5.24	8	5.16
Denmark	9	5.32	7	5.86	9	5.20	9	5.15
Canada	10	5.30	11	5.77	6	5.32	14	4.95
Hong Kong	11	5.30	1	6.12	2	5.48	24	4.46
United Kingdom	12	5.25	18	5.58	7	5.28	12	4.98
Taiwan	**13**	**5.21**	**19**	**5.58**	**16**	**5.5**	**7**	**5.23**
Norway	14	5.14	17	5.65	12	5.13	17	4.83
France	15	5.13	16	5.67	15	5.9	16	4.8

Source: World Economic Forum

3. ECFA and Its Implications for the Czech Economy

The signing of the Economic Cooperation Framework Agreement (ECFA) in 2010 definitely heralded a new era in cross-strait relations. Taiwan hopes to regain some of its export competitiveness and to attract more business and foreign investors. This study aspires to evaluate only the long term impacts that this move can bring to international trade and economic relations with other partners.

The main part of ECFA is so called "Early Harvest Scheme" that outlines a plan for abolition of tariffs in many industries (petrochemical, machinery, textile, transportation, chemicals,

[11] The Global Competitiveness Report, 2010-2011

electronics and certain lines in services). The following tables present the tariff reduction schemes, which should bring the tariffs down to zero in three years for all the agreed lines.

Table 17: Early Harvest commitments in tariffs

	2009 Import Duty (X%)	Negotiated tariff rates 1st year	2nd year	3rd year
Tariff reduction on imports from Taiwan	$0 < X \leq 5$	0		
	$5 < X \leq 15$	5	0	
	$X > 15$	10	5	0
Tariff reduction on imports from China	$0 < X \leq 2,5$	0		
	$2,5 < X \leq 7,5$	2,5	0	
	$X > 7,5$	5	2,5	0

Source: Taiwan Mainland Affairs Council

Many Taiwanese exports (mainly from competitive industries) to China are threatened by products from other ASEAN countries and the inclusion of these products to the early harvest scheme can help Taiwanese producers to maintain their market share. "Since the mainland now accounts for nearly 30% of Taiwan's total exports, by the signing of ECFA with the mainland, Taiwan will indirectly benefit from mainland's FTAs with its trading partners in Southeast Asia." (Hong, 2010)

Some critics of ECFA believe that in the short run the benefits will not be distributed evenly and ECFA will affect positively only big businesses in Taiwan while the higher influx of Chinese imports will make small businesses less competitive.

However, as Table 17 implies, if the EU took advantage of the abolition of tariffs between China and Taiwan, the EU exporters could greatly benefit from this step. Table 18 shows that the level of protection in China before signing ECFA was almost the same for the EU and Taiwan. This suggests the creation of a strategic triangular partnership between EU, Taiwan and China that could benefit all sides. On the other hand, critics could argue that the EU could be flooded with goods, which have higher level of protection in the EU, coming from China through Taiwan. This is not true, as Taiwan also keeps certain products as strategic and sensitive, and in these cases the tariffs are not lowered. The protected products are in line with the EU policy towards Chinese imports.

Table 18: Overview of tariff protection in China, Taiwan and EU (2009)

	China		Taiwan	EU
Product Description	Protection on imports from Taiwan	Protection on imports from EU	Protection on imports from China	Protection on imports from China
Live animals animal products	12.49%	12.49%	15.66%	20.00%
Vegetable products	14.36%	14.36%	21.21%	6.70%
Animal or vegetable fats and oils, animal or vegetable waxes	10.98%	10.98%	4.02%	6.67%
Prepared foodstuffs, beverages, spirits, vinegar, tobacco	16.03%	16.03%	14.98%	12.93%
Mineral products	1.36%	1.36%	0.36%	0.00%
Products of the chemical or allied industries	6.09%	6.09%	1.99%	3.02%
Plastic and rubber articles	8.36%	8.36%	4.25%	5.13%
Raw hides and skins, leather, furskins, saddlery, travel goods, handbags	10.87%	10.87%	5.24%	4.14%
Wood and articles of wood, cork	2.88%	2.88%	1.65%	1.95%
Pulp of wood, paper, paperboard	4.32%	4.32%	0.00%	0.00%
Textiles and textile articles	13.83%	13.83%	9.58%	9.83%
Footwear, headgear, umbrellas, feathers, artificial flowers	15.80%	15.80%	5.35%	9.47%
Articles of stone, plaster, cement, ceramic products, glass and glassware	12.01%	12.01%	7.27%	3.94%
Natural or cultured pekls, precious or semi-precious stones, metals	6.52%	6.52%	0.03%	0.41%
Base metals and articles of base metal	5.72%	5.72%	1.63%	1.76%
Machinery and mechanical appliances, electrical equipment	10.69%	10.69%	1.99%	1.67%
Vehicles, aircraft, vessels and associated transport equipment	17.19%	17.19%	15.68%	7.17%
Optical, photographic, cinematographic, medical or surgical instruments	6.34%	6.34%	1.75%	1.33%
Arms and ammunition	13.00%	13.00%	1.62%	2.32%
Miscellaneous manufactured articles	4.16%	4.16%	1.51%	1.45%
Art and Antibes	10.18%	10.18%	0.00%	0.00%
Agricultural Products	11.12%	11.12%	10.49%	8.95%
Harmonized System	8.48%	8.48%	4.13%	3.26%
Industrial Products	8.06%	8.06%	3.34%	2.70%

Source: Internatiíonal Trade Centre

4. Analysis of Trade Potentials

In the preceding chapter, we have analyzed the logic of the pattern of Czech foreign trade (and the role of Taiwan in it) by estimating a gravity model for Czech imports and exports. The detailed methodology of the estimate is provided in the appendix.

Our estimates of aggregate potential for further increases in mutual trade are based on econometric models of Czech exports and imports derived from traditional gravity models. Gravity models have rich history in empirical analysis of trade data and they have received a great deal of attention as well as more rigorous theoretical foundations during the last two decades. Although their application in trade potential analysis can be criticized for oversimplifications, reliance on point estimates, or for the lack of detail (the typically application is on aggregate trade flows), they remain an important and widely applied analytical instrument[12]. Moreover, trade potential analysis based on gravity models may constitute the only feasible option in a situation where the exact form of subsequent liberalization is not known or sufficiently detailed and reliable data are not available.

We used separate models of Czech import function and Czech export function based on a panel dataset containing information about trade of the Czech Republic with 177 trade partners during 1995-2009.[13] The dataset thus covers basically the whole period and all trade partners which can be meaningfully analyzed. The detailed specification, description of the data used for estimation and standard specification tests of the applied models are described in the Appendix II**.** The scope for further trade expansions are derived from the sensitivity of the import and export functions to the variable describing the degree of protectionism and from residuals/fixed effects which can be used to approximate joint effects of difficult to measure variables related to non-tariff barriers and of other disturbing elements.

Estimates of gravity models for Central Eastern European (CEE) countries often suggest[14] that the changes in territorial pattern of trade experienced by CEE countries after 1989 were more or less a return to normal. Indeed, e.g. Jakab et al.(2001) suggest even after the dramatic increase in the dependence on the EC/EU countries in 1990s there still was some potential for even further increases of trade with EU member countries. This tendency towards Europocentric trade orientation may be further reinforced by future monetary integration.

The results suggest that the current Czech economy has a natural propensity to focus on European markets. Our gravity model of trade (capable of explaining about 93% of variability in Czech exports and 91% for imports during 1996-2009) confirms conclusions of

[12] See e.g. Baldwin (1993), Breuss and Egger (1999), and Jakab et al.(2001) for selected examples of application on analysis of trade potentials

[13] The dataset was constructed by Vladimir Benáček.

[14] E.g. discussion in Jakab et al.(2001)

previous studies, i.e. that the extreme increase in the role of EU countries in the foreign trade experience by the Czech Republic (and Visegrad countries) during 1990s was to a large extent a natural phenomenon, a correction of a previous distortions. The results suggest that this tendency will continue in spite of possible liberalization of trade with Taiwan, indeed our results suggest the low role of measurable trade policies in determination of bilateral trade flows, especially in the case of exports (coefficients for variables measuring describing the role of FTA and European integration were not statistically significant).

If we accept the point estimates (see the appendix II for more detailed description of the issues related to this), we could expect a very small increase of exports (possibly around 1%) and of imports by up to 20% in the extreme case of complete liberalization. However, the results also suggest that other barriers (lack of experience, cultural distance) act as a substantially higher trade barrier than current trade policy. The calculated numbers also have to be seen in the context of extreme inconsistencies of mutual trade data and the important role of complicated indirect exports.

5. Structural Effects of Trade Liberalization

Estimating usable results that would throw further light on details of effects of possible trade liberalization is relatively complicated:

- The current role of Taiwan in Czech foreign trade (especially exports) is not only small, but the trade data seem to be plagued with lots of omissions. The estimates based on official direct flows are very low; the inclusion of estimates of indirect flows brings additional risks of further errors and imprecision.
- Czech exports seem to be fairly unstable (both in volume and composition)[15], which makes the estimation of a trends and elasticity complicated due to breaks in the data.
- The post-liberalization trade policies are not known.

In addition to this, given the specific role of the Czech Republic in the EU-wide division of labor, the resulting effects of trade liberalization may be fairly complicated. In principle we should expect the following channels to play a major role in post-liberalization adaptation:

- Substitution effects between Czech products which are direct competitors of Taiwanese imports both in the Czech market and in the market of the whole EU. This effect would lead to lower growth or even decline of output of the afflicted sectors and is likely to play a major role only if trade is more substantially influenced by interplay between EU-Taiwan liberalization and Taiwan-P.R.C. FTA.

[15] The extent of this instability heavily depends on the source of data – see Appendix I for more details.

- Complementarities between Czech products and vital components from Taiwan both within the Czech market as well as in other EU countries which would be using inputs from both Taiwan and the Czech Republic. This effect would lead to higher growth of output of the afflicted sectors.

- Income effect caused by post-liberalization increase in national incomes of the participating countries. This is likely to increase domestic consumption of Czech products, their sales in EU markets as well as their exports to Taiwan.

The first best option in this situation would be to use a full-scale computable general equilibrium (CGE) model (e.g. based on GTAP). Unfortunately, given the current problems with availability of data, the costs of this solution would outweigh the benefits.[16] This is the reason why our analysis of sectoral effects is based not on full-scale CGE model but on much simpler input-output based simulation.[17] The reported results therefore include direct and indirect effects of simulated trade shocks, but at the current stage not the simulated induced effects. However, this omission is not too severe in the case of the Czech Republic because of its relatively small size and high openness, which substantially decreases the strength of the impacts of increases of income on domestic consumption.

Let us assume that the liberalization would lead to a 20% symmetric (equi-proportional) positive shock to Czech exports to Taiwan (the results in the previous section show that this would be an extremely optimistic result). This quite significant shock would increase total use of domestically produced output only by 16.8 mil. Euro when we use the lower bound of values of Czech exports (i.e. exports reported by Eurostat), in relative terms this means an increase by less than 0.007% of pre-liberalization output. Even the sectors experiencing the higher relative increase in the demand for its output (other transport equipment) would still experience increase lower than 0.05% of their original output.

When we use the upper bound of the estimates of Czech exports to Taiwan (i.e. direct exports + indirect exports + goods embodied in German commodities exported to Taiwan), we arrive at significantly higher values: +35.6 mil. Euro, or in relative terms +0.014% increase in demand for Czech output. The most intensively influenced sector (Electrical, radio, television and communication equipment and apparatus) would experience an increase in demand for its output amounting to slightly more than 0.08% of the pre-liberalization value.

[16] As of now it seems that GTAP database suffers from the same issues related to reliability of export and import data as Eurostat statistics.

[17] The simulation uses symmetric input-output tables for 2005. As usual, we assume that the structure of the IO tables should be relatively stable in the short run.

6. Summary and Conclusions

The Czech Republic is not likely to be substantially influenced by trade liberalization with Taiwan. The estimates suggest very moderate effects of even more than realistic increase in mutual trade. The main reason for this is the current very low base of Czech exports to Taiwan. Even if mutual trade is completely liberalized, the gravity model suggests that the Czech Republic will remain focused on European trade partners – i.e. unless Czech government attempts to intervene in a way that would increase diversification of Czech exports. However, fast and significant diversification is unlikely in the short term.

Effects of mutual trade liberalization increase, if we take into account indirect exports of Czech commodities via other EU countries (esp. Germany) or when we assume that trade liberalization between EU and Taiwan will interact positively with trade liberalization between Taiwan and P.R.C. Dramatic effects are unlikely even in this case.

However, other less tangible effects and difficult to calculate effects are possible, most importantly the learning effects. Czech companies often lack experience necessary for penetrating into Asian markets successfully. Making the access to Taiwanese market easier means that they will be able to learn in a market which is easier for orientation and better institutionally developed than other Asian markets. We can therefore expect indirect positive long-term effects which may lead to diversification of Czech exports.

Besides policy recommendations concerning export policies and trade liberalization we would also like to emphasize the need for accurate data (see appendix for more details on this issue). A detailed revision and analysis of mutual trade flows would therefore be a useful first step on the path to further trade liberalization.

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a. Statistics

International Trade Centre

World Trade Organization

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Eurostat: COMEXT database and data input-output tables and import matrices

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Appendix I – Inconsistencies in Statistics on Mutual Trade

It is a well-known fact that trade data are often not perfect – mirror statistics mostly do not fit because of pricing problems (CIF v. FOB) and omissions related to smuggling and tax evasions. However, the issues that are obscuring the true extent of trade between the Czech Republic and non-EU countries have slightly different nature related to (i) organization of statistical reporting, (ii) dependence of Czech economy on core EU countries, especially Germany.

Concerning the first effect – trade statistics on trade within the EU are collected in a different way than statistics on extra-EU trade.[18] Gathering of data on Intra-EU trade (Intrastat) is paradoxically complicated by the advanced degree of economic liberalization achieved by EU countries. Missing borders mean that large part of this trade is basically estimated. Unfortunately, it is often not easy to find out the final destination of products imported from non-EU countries; EU members with important ports (e.g. Rotterdam – hence the "Rotterdam effect[19]) often end up with relatively higher imports and inland countries such as the Czech Republic with lower reported imports from non-EU countries. The relevance of this issue for trade between the Czech Republic and Taiwan can be easily demonstrate by comparing relevant data from European, Czech, and Taiwanese trade statistics.

While we should expect the data not to be completely identical because of pricing issues[20] and currency conversions,[21] the extent of the differences (especially between European and Czech data) is extreme, especially in the case of imports. Chart 1 compares the value of Czech merchandise imports from Taiwan during 2004-2010 according to the Czech Statistical Office (CSU), Eurostat; and Taiwanese trade data on exports to the Czech Republic.[22] Czech imports from Taiwan reported by CSU are in some years more than 100% higher than imports reported by Eurostat; while both values are consistently higher than Taiwanese exports to the Czech Republic as reported by Taiwanese trade statistics. While part of this difference is due to pricing (CIF prices used for imports are in general higher than FOB export prices), the main likely culprit is the "Rotterdam effect".

[18] So-called Intrastat and Extrastat.

[19] See e.g. Herrigan et al. (2005)

[20] Data on Taiwanese exports to the Czech Republic will be in FOB prices, data on Czech imports in CIF prices

[21] Taiwanese trade statistics report the value of trade flows in USD. If a trade operation was denominated in other currency, its value was converted to USD and TWD according to Taiwanese statistical standards. For the sake of comparison we had to reconvert the data into Euro. The conversion exchange rate was based on average exchange rates taken from Pacific Exchange Rate Service and it was most likely slightly different than exchange rates used for the original reporting. This currency problem unfortunately cannot be avoided as detailed data on exchange rates used by statistical and customs offices mostly are not available.

[22] The "reexports" data are provided by Taiwanese Bureau of Foreign Trade, they do not address the issues related to Czech reexports and exports via final products manufactured in third countries (Germany) discuss in this study.

Chart 2 shows the same type of data, but for exports. This time we are using Czech and European export statistics and Taiwanese import data.[23] As apparent from the chart, the export data seem to show lower relative dispersion than import data.

Chart 1 - Czech Imports from Taiwan, thousands of EUR

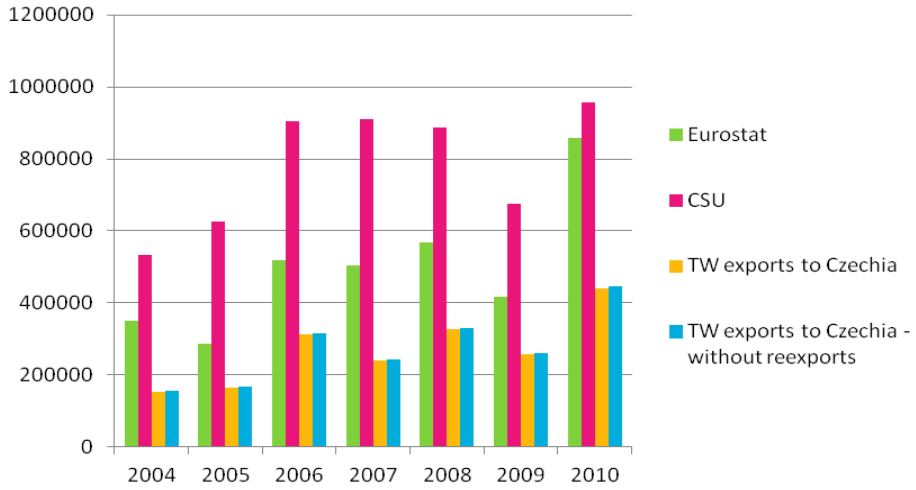
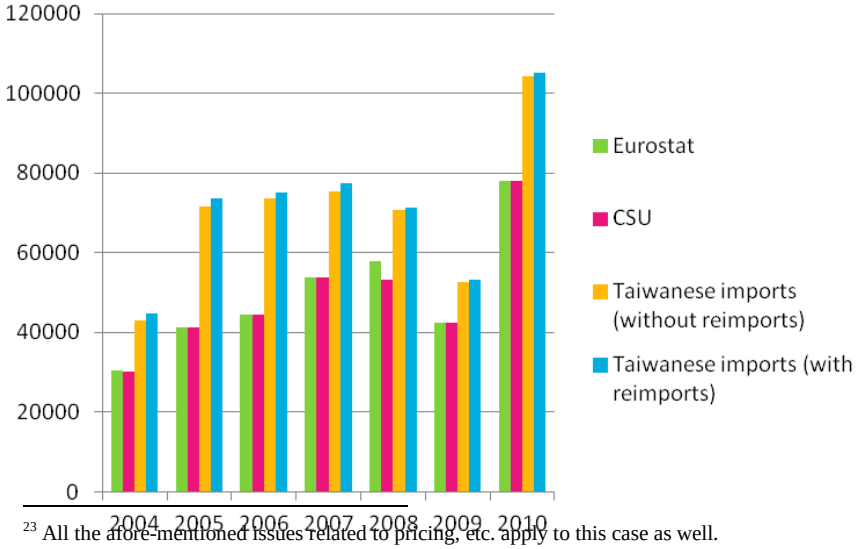


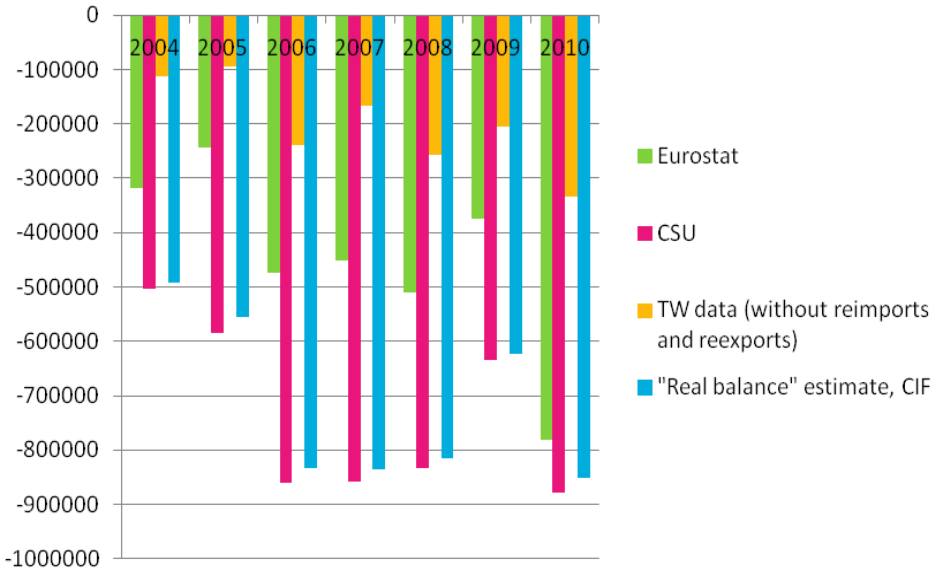
Chart 2 - Czech Exports to Taiwan, thousands of EUR



[23] All the afore-mentioned issues related to pricing, etc. apply to this case as well.

Correction of these inconsistencies can be relatively complicated, but it is possible to construct a simple, but still slightly more realistic estimate of the "true" balance of trade between the countries by assuming that data on the geographical pattern of imports gathered (and estimated) by national statistical office are more precise than data on exports. This estimate would be based on the difference between Czech data on imports from Taiwan and Taiwanese data on imports from the Czech Republic. The resulting estimates (and their comparison with balance of trade calculated from data obtained from Eurostat, CSU, and Taiwanese authorities) are shown in Chart 3.

Chart 3 -Balance of trade, thousands of Euro



The chart shows reveals that trade balances from Statistics of CSU are relatively close to our modified estimates. This is one of the reasons why we were mostly relying on the CSU data in this analysis. The chart however reveals another striking fact that may cause troubles during negotiations on trade liberalization. Taiwanese trade surplus is much lower according to Taiwanese data than according to Czech data.

The second type of issues which obscure the real importance of Taiwan (and other Asian countries) in Czech foreign trade, are related to the dependence of Czech economy on EU markets. The restructuring of foreign trade which took place after 1989 had a lasting effect

on Czech exports to distant territories. Czech companies mostly abandoned the markets and focused on nearer markets (Germany, Austria, Slovakia, and Poland). In addition to this, the Czech Republic often exports components or even products declared as "finished goods" which are later used as intermediate inputs in German production and German exports to Asian markets. This effect goes beyond simple re-exports, and it is especially important for Czech exports to the P.R.C. The relevance of this effect means that trade liberalization between the EU and Taiwan positively influences Czech economy not only because of direct exports, but also because of indirect exports of Czech goods embodied into German export products. As of now, there are no detailed and reliable analyses of this effect available (although e.g. Loschky a Ritter (2006) analyzed the increasing import dependence of German exports), therefore we attempted a simple estimate based on trade data and available information on input-output tables (and relevant import matrices) for Germany.

The approximate role of this type of trade can be estimated from data on trade between the Czech Republic and Germany, Germany and Taiwan, and detailed input-output tables (esp. so called import matrix for Germany). The import matrix gives us information on use of imported commodities for direct further exports (from Germany to all countries) and on the use of imported commodities for production of output in Germany. We can estimate the importance of both types of trade in the following way:

- For direct re-exports: for every category of commodities/services we use the relative share of Taiwan in German exports, the relative share of the CR in German imports, and the data on re-exports from the import matrix.
- Estimate of indirect exports of imports which are embodied in final German output is more complicated – we need to estimate how high is the demand for imports generated by exports to Taiwan and then we use the relative share of CR in German imports to obtain a guess of possible exports from the Czech Republic.

Methodology

We assume that Czech products end up in Taiwan in ways which can cause that the export does not appear in official statistics (at least not fully). This hidden export has two components: goods re-exported from Germany without substantial change and goods which enter the production of exportable commodities in Germany.
Let us define:

ϕ_{cz}^{TW} as a vector of total indirect flows of goods from the Czech Republic to Germany; it is a vector with k dimensions corresponding to k categories in the trade classification used in the calculations (CPA 2002 in our case).

ϕ_{cz}^{TW} further decomposes into: $\phi_{cz}^{TW} = \delta_{cz}^{TW} + \varepsilon_{cz}^{TW}$

Where:

δ_{cz}^{TW} is the direct re-export (i.e. goods that were imported into Germany but were directly used to satisfy demand for German exports)
ε_{cz}^{TW} is the export of Czech commodities embodies in "domestic" German products which end up in foreign markets.

Again both variables are vectors with k dimensions.

Let us also define two proportionality vectors:

Components of π_{cz}^{G} measure the share of Czech imports in total German imports in each of the k categories: $\pi'^{G}_{CZ} = \left(\frac{m^{G}_{1CZ}}{m^{G}_{1}}, ..., \frac{m^{G}_{kCZ}}{m^{G}_{k}} \right)$,
and components of π_{G}^{CN} measure the share of German exports to Taiwan in total German exports for each of the k categories: $\pi'^{TW}_{G} = \left(\frac{x^{G}_{1TW}}{x^{G}_{1}}, ..., \frac{x^{G}_{kTW}}{x^{G}_{k}} \right)$.

Import matrix which describes the use of imported commodities in German economy and which can be obtained for Eurostat (currently the table describing the situation in 2007) can be understood as a realization of the following matrix equation (capital letters denote matrices, small letters vectors) which describes the use of imported commodities in German economy:

$$m_G = M_G \cdot y_G + d_G^m + \delta_G^m \qquad (1)$$

Where m_G stands for the vector of total German imports (again with k components), M_G is the matrix describing the use of imported commodities in production of individual sectors of German economy, y_G is the vector of output produced in Germany (k components), d_G^m is direct domestic demand for imported commodities, δ_G^m are the direct re-exports of the commodities imported into Germany.

Assuming that the proportion of Czech imports in German imports in each category is independent of the use of the commodity/service (a fairly strong assumption but necessary because of constraints dictated by the availability of data) and that the proportion of

Germany exports to Taiwan to total German exports is independent of the use of the commodity/services, we can directly obtain the solution for δ_{cz}^{CN}:

$\delta_{CZ}^{TW} = \pi_{CZ}^{G} \bullet \delta_{G} \bullet \pi_{G}^{TW}$ where $\bullet$ stands for multiplication of the corresponding components of the two vectors (component by component product of the vectors).

Obtaining results for ε_{cz}^{CN} is only slightly more complicated. We need to obtain the link between output produced in Germany and German exports. This is provided by standard input-output table for German economy and the well-known matrix equation which describes it (notation has been adapted to match the rest of the procedure):

$$y_{G}^{d} = A_{G} \cdot y_{G}^{d} + d_{G}^{d} + \delta_{G}^{d} \qquad (2)$$

Where d_{G}^{d} stands for domestic demand for German commodities, δ_{G}^{d} are direct exports of German commodities, A_G is the matrix of technical coefficients derived from the input-output table, y_{G}^{d} is the vector (k components) describing German domestically produced output.

Solving the matrix equation (2) gives us expression which measures how much of German output is being produced to meet the demand for German exports:

$$\left(y_{G}^{d}\right)_{exports} = \left(I - A_{G}\right)^{-1} \cdot \delta_{G}^{d} \qquad (3)$$

Finally, using the proportionality vectors (again with the strong assumption about their stability) and substituting (3) into (1) leads to the following expression:

$$\varepsilon_{CZ}^{TW} = \pi_{CZ}^{G} \bullet M_{G} \cdot \left(I - A_{G}\right)^{-1} \cdot \left(\pi_{TW}^{G} \bullet \delta_{G}^{d}\right)$$

The total Czech indirect exports to Taiwan are therefore given by:

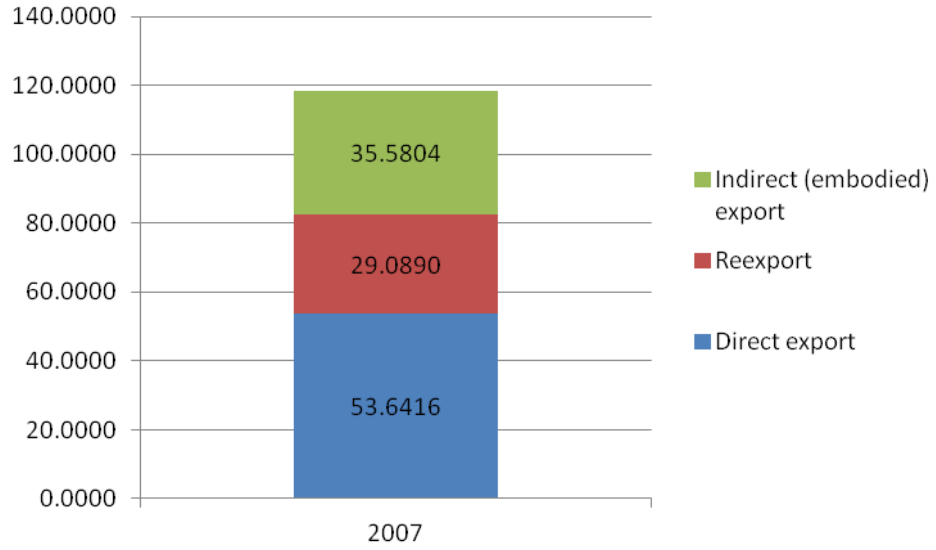
$$\phi_{CZ}^{TW} = \delta_{CZ}^{TW} + \varepsilon_{CZ}^{TW} = \pi_{CZ}^{G} \bullet \delta_{G} \bullet \pi_{G}^{TW} + \pi_{CZ}^{G} \bullet M_{G} \cdot \left(I - A_{G}\right)^{-1} \cdot \left(\pi_{TW}^{G} \bullet \delta_{G}^{d}\right)$$

The same procedure can be applied for estimates of the use of Taiwanese products in Czech exports to EU 27 countries.

Detailed Results

We estimated both components with the use of German input-output table and import matrix for 2007 and with the use of data on German and Czech trade in 2007 according to CPA 2002 classification. The aggregate results are depicted in the following chart.

Chart 4 - Estimates of Indirect Exports from the CR to Taiwan in 2007. Mil. of Euro



This estimate suggests that the CR depends on Taiwanese economy about twice as much as it would appear from official data. Interestingly enough, the sum of direct exports and of estimated reexports for 2007 is fairly close to the value of Taiwanese imports from the Czech Republic. However, in addition to this, there are another about 35 mil. euro worth of Czech goods and services which are exported to Taiwan as part of German products.

When we look at detail breakdown by sector (Table 16), we find out that not too surprisingly the sectors most intensively participating in this type of trade are the sectors receiving the high share of FDI from old EU countries and sectors playing a very important role in Czech manufacturing exports to the EU.

Table 19 - Sectors ranked according to the contribution of indirect trade. Mil. of EUR

Sector	Direct export	Re-exports	Indirect (embodied) exports
Machinery and equipment n.e.c.	8.491	6.595	5.636
Electrical machinery and apparatus n.e.c.	3.599	5.839	4.332
Radio, television and communication equipment and apparatus	5.960	4.476	2.858
Motor vehicles, trailers and semi-trailers	0.121	3.065	3.383
Basic metals	4.163	0.659	5.513
Chemicals, chemical products and man-made fibres	4.465	2.376	2.160
Fabricated metal products, except machinery and equipment	2.056	0.608	2.942
Rubber and plastic products	1.412	0.517	1.895
Office machinery and computers	6.617	0.976	0.759
Medical, precision and optical instruments, watches and clocks	1.672	1.324	0.342
Printed matter and recorded media	0.317	0.382	1.080
Furniture; other manufactured goods n.e.c.	2.156	1.026	0.303
Other non-metallic mineral products	7.486	0.431	0.732
Computer and related services		0.000	1.074
Pulp, paper and paper products	0.240	0.180	0.627
Textiles	0.304	0.213	0.206
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	0.583	0.028	0.374
Coke, refined petroleum products and nuclear fuels		0.003	0.380
Other business services		0.002	0.373
Products of agriculture, hunting and related services	0.042	0.018	0.181
Food products and beverages	0.532	0.057	0.090
Leather and leather products	0.521	0.101	0.040
Recreational, cultural and sporting services	0.078	0.005	0.126
Other transport equipment	2.667	0.084	0.037
Wearing apparel; furs	0.086	0.094	0.011
Other mining and quarrying products	0.047	0.003	0.051

Coal and lignite; peat	0.000	0.001	0.040
Products of forestry, logging and related services		0.005	0.033
Tobacco products		0.019	0.001
Fish and other fishing products; services incidental of fishing	0.027	0.000	0.001

Appendix II – Gravity Model used for Trade Potential Analysis

Econometric Specification

The gravity model used in our paper has a long history dating back to Isard (1954) and Tinbergen (1962). Correct econometric specification that may lead to unbiased estimates of all parameters has got to be based on an acceptable theoretical framework. These modern theoretical foundations have been provided first by Anderson (1979), current theoretical version typically builds upon Anderson & van Wincoop (2003). However, as Baldwin and Taglioni (2006) clearly demonstrate, a clearer idea of theoretical foundations was not always reflected in correct econometric specification in applied analysis, especially as far as correct treatment of the multilateral trade resistance term is concerned. Our model is based on unilateral trade flows (Czech Republic v. rest of the world) and uses dummy variables designed to deal with the potential pitfalls outlined in Baldwin and Taglioni (2006). The basic specification takes the following form:[24]

$$X_{ijt} = \alpha \cdot Y_{it}^{\beta_1} \cdot Y_{jt}^{\beta_2} \cdot L_{jt}^{\beta_3} \cdot D_{ijt}^{\beta_4} \cdot RV_{ijt}^{\beta_5}, \text{ resp. } M_{ijt} = \alpha \cdot Y_{it}^{\beta_1} \cdot Y_{jt}^{\beta_2} \cdot L_{jt}^{\beta_3} \cdot D_{ijt}^{\beta_4} \cdot RV_{ijt}^{\beta_5}$$

Where X_{ij} (M_{ij}) measures trade between the Czech Republic and its trade partner, Y_i (Y_j) is Czech (foreign) GDP, L_j is foreign population and D_{ij} measures mutual distance. The term RV stands for remaining variables which should help to account for the multilateral trade resistance term (we included measures of government effectiveness and institutional development, qualitative variables describing monetary and trade integration) and year dummies/trade partner specific dummies.

The relationship was estimated in a semi-logarithmic form, all variables other than the components of RV were used in logarithms, while the components of RV were used directly because of their specific form (qualitative variables and dummies):[25]

$$x_{ijt} = \gamma_j + \beta_1 \cdot y_{it} + \beta_2 \cdot y_{jt} + \beta_3 \cdot l_{jt} + \beta_4 \cdot d_{ijt} + \sum_{k=1}^{p} \delta_k RV_{k_{ijt}}$$

[24] Czech population was excluded from the set of variables (although it appeal in similar other studies) because of relatively low variability of the variable.

[25] Lower case letters denote variables in logarithms.

resp. $m_{ijt} = \gamma_j + \beta_1 \cdot y_{it} + \beta_2 \cdot y_{jt} + \beta_3 \cdot l_{jt} + \beta_4 \cdot d_{ijt} + \sum_{k=1}^{p} \delta_k RV_{k_{ijt}}$

Sources of data

The dataset combines variables from several different sources. The main variables considered in the models (and their origin) are described in the following list:

- Trade data from Eurostat[26] in Euro
- Data on GDP (in purchasing power parity and nominal) from Eurostat and IMF respectively
- Distances and related measures from the databases provided by CEPII
- Variables describing government effectiveness from Worldbank
- Variables describing institutional factors from Heritage foundation
- Population from IMF International Financial Statistics
- Measures of currency integration – artificial variable derived by V. Benáček from WTO, UNCTAD and other sources.
- Measures of trade barriers – artificial variable derived by V. Benáček from WTO, UNCTAD and other sources.
- Recession dummy which filters out the effects of financial crisis in 2008 and 2009. This variable was only used in specifications without year dummies.

Our specification (or rather their various versions[27]) thus included all traditional variables typical for gravity models with one exception which can be relevant for the case of Taiwan. This one exception is a measure of cultural distance or language dissimilarity. This variable was not available in a form that would be meaningful for the case of Czech Republic.

Our data describe trade between the Czech Republic and 177 trade partners during 15 years (1995-2009). The sample thus covers every possible partner (including e.g. DPRK) and all years that can be used without risking too many problems with uniqueness of transition related data and changes in statistical methodologies.

[26] In spite of the criticism of the reliability of the data we were forced to use them mainly for technical reasons.
[27] Contact authors for unreported versions of the estimates and other details.

Results

We estimated the two specifications by random effects, fixed effects, and pooled regressions.[28] As we wanted to use "out-of-sample" forecast, we excluded Taiwan from the sample for the estimation of the gravity relationship. Standard tests (Hausman test, test of differing group intercepts, Breusch-Pagan test) were used to test the specification. Results are described in the following two tables (standard errors are reported in the brackets, asterisks stand for significance at 5% significance level)[29]:

Table 20 - Estimates of Czech Export Function

Variable	Random Effects TW in sample	Random Effects without TW	Fixed Effects[30] (robust S.E.) TW in sample
Dependent variable: ***log exports from the Czech Republic to country j***			
Constant	-6.230** (2.148)	1.143 (15.638)	-18.538** (3.259)
Ln (Y_j)	0.940** (0.068)	0.944** (0.069)	0.700** (0.216)
Ln (Y_{CR})	0.898** (0.178)	0.264 (1.338)	1.001** (0.381)
Ln (L_j)	0.117 (0.073)	0.112 (0.073)	0.706 (0.691)
Ln (D_{ij})	-1.517** (0.108)	-1.519** (0.108)	xxx
$ERDI_j$	-0.254** (0.044)	-0.254** (0.044)	-0.283** (0.080)
$Business_j$	0.008** (0.002)	0.008** (0.002)	0.007 (0.003)
$Corruption_j$	-0.004* (0.002)	-0.004* (0.002)	-0.005 (0.004)

[28] Not reported as the zero significance of fixed effects was always rejected by standard statistical tests.

[29] Results for time dummies and country level fixed effects are not reported.

[30] We only report the results of fixed effects with Taiwan in the sample as the random effect version was preferred for both versions of the estimate.

EU/EEA_{ij}	0.105 (0.175)	0.106 (0.175)	0.164 (0.194)
FTA/CU_{ij}	0.008 (0.121)	0.006 (0.122)	0.021 (0.117)
$Borders_{ij}$	0.445 (0.616)	0.449 (0.618)	xxx

Statistical tests in this case led to the preference for the random effect model (Hausman test did not reject its consistency, Breusch-Pagan test rejected zero variance of the unit specific error).In the case of Czech exports we reached an interesting conclusion. In the reported as well as in numerous unreported specifications of the export function we found out that Czech exports are not significantly sensitive to our measures of trade policy (the estimated coefficients had the expected sign but we were not able to reject that they are equal to zero). This would lead to fairly skeptical conclusions for the prospects of a significant increase in the volume of Czech exports as a response to the liberalization of trade with Taiwan. Using the point estimates from the random effect specification, we should expect exports to Taiwan increase by 0.6-0.8% thanks to direct influence of the FTA.

When we used the estimated export functions to forecast Czech exports to Taiwan, we found out, that there does not seem to be too much of unused export potential for the Czech economy. Indeed exports predicted for Taiwan by our model (estimated on the sample which excluded Taiwan) suggested that current exports to Taiwan are actually slightly better than results achieved in other markets. It is vital not to overestimate the significance of the results as they may be driven by the use of imperfect measures for the description of mutual trade policies. However, they still suggest that the likely directly measurable effects of formal trade liberalization are likely to be very limited. Given the weak statistical significance of trade policy related variables in our models we are not convinced that the mutual trade policy is the main barrier. Trade seems to be hindered rather by cultural differences and insufficient experience of Czech managers. The underlying data do not account for the indirect trade, the role of which we have identified as rather important. We would therefore assume that the most significant impact on Czech exports will come from the indirect exports via Germany. In other words, the trade liberalization is likely to influence more strongly German exports to Taiwan (at least in the short run) and Czech business will benefit from increased exports to Germany.

We estimated an import function for the same set of data (again with and without Taiwan). We came to similar conclusions as in the case of exports. Czech imports seem to be less dependent on mutual trade relations as measured by regional trade agreements, but seem to be fairly sensitive to distance (and to the quality of business environment). If we use the estimated coefficient on FTAs/Customs unions (this is mainly for illustration as we are not able to reject the null hypothesis that the coefficient is actually equal to zero), we would get possibly about 20% increase in imports related to a creation of a free trade area. Again the

results are made weaker by the fact that the underlying data came from Eurostat and do not adequately account for possible re-exports and indirect re-exports.

Table 21 – Estimates of Czech Import Function

Variable	Random Effects TW in sample	Random Effects without TW	Fixed Effects (robust S.E.) without TW
Constant	-13.556** (2.822)	-31.802 (19.917)	-39.710** (15.953)
Ln (Y_j)	1.198** (0.060)	1.190** (0.060)	0.899** (0.358)
Ln (Y_{CR})	0.811** (0.226)	2.400 (1.704)	2.616* (1.362)
Ln (D_{ij})	-1.016** (0.159)	-1.033** (0.160)	xxx
$ERDI_j$	0.029 (0.054)	0.028 (0.054)	-0.006 (0.107)
$Business_j$	0.016** (0.003)	0.017** (0.003)	0.015** (0.006)
$Corruption_j$	-0.009** (0.003)	-0.010** (0.003)	-0.011** (0.005)
EU/EEA_{ij}	0.551** (0.227)	0.558** (0.228)	0.300 (0.246)
FTA/CU_{ij}	0.186 (0.156)	0.188 (0.156)	0.089 (0.164)
$Borders_{ij}$	1.478 (0.952)	1.472 (0.949)	xxx

Appendix III - Structural Effects of Increase of Exports to Taiwan

The following table shows detailed results of simulated effects of increase in the current trade with Taiwan by 20%. There are two scenarios: (i) symmetric increase (every sector increases exports to Taiwan by 20% of original exports); (ii) increase focused on manufacturing industry. The results are based on input-output table for the Czech economy in 2005 and data on mutual trade from Eurostat statistics for 2007. They include neither the induced effects of the increased demand nor the effects of indirect additional exports via Germany. Therefore they would constitute a lower bound of the estimates of possible effects of this type of shocks. As apparent from the table, the results of the two scenarios are fairly similar (this is caused by current composition of exports to Taiwan) and in both cases they add up to a fairly small total effect on the Czech economy (about +0.006% of total output).

Table 22 - Estimates Effects of 20% Increase in Exports to Taiwan

Sector	Symmetric shock	Increase in demand for manufacturing products only
Products of agriculture, hunting and related services	0.001	0.001
Products of forestry, logging and related services	0.006	0.006
Fish and other fishing products; services incidental of fishing	0.019	0.000
Coal and lignite; peat	0.004	0.004
Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying	0.004	0.004
Uranium and thorium ores	0.000	0.000
Metal ores	0.018	0.018
Other mining and quarrying products	0.016	0.014
Food products and beverages	0.002	0.002
Tobacco products	0.000	0.000
Textiles	0.004	0.004
Wearing apparel; furs	0.002	0.002
Leather and leather products	0.033	0.033
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	0.009	0.009
Pulp, paper and paper products	0.006	0.006
Printed matter and recorded media	0.005	0.005
Coke, refined petroleum products and nuclear fuels	0.006	0.006

Chemicals, chemical products and man-made fibres	0.019	0.019
Rubber and plastic products	0.008	0.008
Other non-metallic mineral products	0.041	0.041
Basic metals	0.018	0.018
Fabricated metal products, except machinery and equipment	0.010	0.010
Machinery and equipment n.e.c.	0.020	0.020
Office machinery and computers	0.033	0.033
Electrical machinery and apparatus n.e.c.	0.014	0.014
Radio, television and communication equipment and apparatus	0.034	0.034
Medical, precision and optical instruments, watches and clocks	0.024	0.024
Motor vehicles, trailers and semi-trailers	0.000	0.000
Other transport equipment	0.049	0.049
Furniture; other manufactured goods n.e.c.	0.015	0.015
Secondary raw materials	0.016	0.016
Electrical energy, gas, steam and hot water	0.004	0.004
Collected and purified water, distribution services of water	0.002	0.002
Construction work	0.001	0.001
Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel	0.003	0.003
Wholesale trade and commission trade services, except of motor vehicles and motorcycles	0.006	0.006
Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	0.003	0.003
Hotel and restaurant services	0.001	0.001
Land transport; transport via pipeline services	0.004	0.004
Water transport services	0.001	0.001
Air transport services	0.000	0.000
Supporting and auxiliary transport services; travel agency services	0.003	0.003
Post and telecommunication services	0.002	0.002
Financial intermediation services, except insurance and pension funding services	0.003	0.003
Insurance and pension funding services, except compulsory social security services	0.004	0.004
Services auxiliary to financial intermediation	0.003	0.003
Real estate services	0.001	0.001

Renting services of machinery and equipment without operator and of personal and household goods	0.003	0.003
Computer and related services	0.003	0.003
Research and development services	0.002	0.002
Other business services	0.003	0.003
Public administration and defence services; compulsory social security services	0.000	0.000
Education services	0.000	0.000
Health and social work services	0.000	0.000
Sewage and refuse disposal services, sanitation and similar services	0.002	0.002
Membership organisation services n.e.c.	0.001	0.001
Recreational, cultural and sporting services	0.001	0.000
Other services	0.000	0.000
Private households with employed persons	0.000	0.000
Total Effect	**0.007**	**0.007**

When we include the indirect trade (assuming the same symmetric shock for both German and Czech trade with Taiwan), the total effect increases, but remains still fairly low: less than +0.01% of the pre-shock output - see the next table for details.

Sector	**Symmetric shock**
Products of agriculture, hunting and related services	0.002
Products of forestry, logging and related services	0.007
Fish and other fishing products; services incidental of fishing	0.001
Coal and lignite; peat	0.005
Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying	0.005
Uranium and thorium ores	0.000
Metal ores	0.026
Other mining and quarrying products	0.008
Food products and beverages	0.001
Tobacco products	0.001
Textiles	0.005
Wearing apparel; furs	0.002

Leather and leather products	0.009
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	0.009
Pulp, paper and paper products	0.014
Printed matter and recorded media	0.017
Coke, refined petroleum products and nuclear fuels	0.009
Chemicals, chemical products and man-made fibres	0.020
Rubber and plastic products	0.013
Other non-metallic mineral products	0.007
Basic metals	0.027
Fabricated metal products, except machinery and equipment	0.017
Machinery and equipment n.e.c.	0.029
Office machinery and computers	0.009
Electrical machinery and apparatus n.e.c.	0.037
Radio, television and communication equipment and apparatus	0.042
Medical, precision and optical instruments, watches and clocks	0.024
Motor vehicles, trailers and semi-trailers	0.010
Other transport equipment	0.003
Furniture; other manufactured goods n.e.c.	0.010
Secondary raw materials	0.024
Electrical energy, gas, steam and hot water	0.004
Collected and purified water, distribution services of water	0.002
Construction work	0.001
Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel	0.005
Wholesale trade and commission trade services, except of motor vehicles and motorcycles	0.008
Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	0.003
Hotel and restaurant services	0.001
Land transport; transport via pipeline services	0.004
Water transport services	0.002
Air transport services	0.000
Supporting and auxiliary transport services; travel agency services	0.003

Post and telecommunication services	0.003
Financial intermediation services, except insurance and pension funding services	0.003
Insurance and pension funding services, except compulsory social security services	0.004
Services auxiliary to financial intermediation	0.003
Real estate services	0.002
Renting services of machinery and equipment without operator and of personal and household goods	0.004
Computer and related services	0.011
Research and development services	0.005
Other business services	0.004
Public administration and defence services; compulsory social security services	0.000
Education services	0.000
Health and social work services	0.000
Sewage and refuse disposal services, sanitation and similar services	0.002
Membership organisation services n.e.c.	0.002
Recreational, cultural and sporting services	0.002
Other services	0.000
Private households with employed persons	0.000
Total Effect	**0.008**

Using the same methodology, we can also analyze in which sectors the expansion of exports leads to the highest positive effects for the Czech economy. The results are presented in the following table, which includes (i) traditional Rasmussen-Hirschman linkage coefficients (RH) which show how high increase in total output of the economy will be caused by a unit increase in demand for output of the particular sector; and (ii) export weighted RH which show how high increase of total output of Czech economy (in thousands of Euro) we can achieve by expanding exports of the given product to Taiwan by 10%.

Table 23 - Effects of an Increase in Total (Direct + Indirect) Exports

	RH Linkage Index	Total Effects of 10% increase in Exports (Thous. Euro)
Machinery and equipment n.e.c.	1.5985	1357.2
Other non-metallic mineral products	1.8057	1351.7
Office machinery and computers	1.2946	856.6
Radio, television and communication equipment and apparatus	1.2474	743.4
Basic metals	1.7732	738.2
Chemicals, chemical products and man-made fibres	1.6172	722.1
Electrical machinery and apparatus n.e.c.	1.5140	544.9
Other transport equipment	1.5987	426.3
Fabricated metal products, except machinery and equipment	1.7440	358.5
Furniture; other manufactured goods n.e.c.	1.5990	344.8
Medical, precision and optical instruments, watches and clocks	1.3938	233.1
Rubber and plastic products	1.5356	216.9
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	2.0320	118.4
Food products and beverages	2.1648	115.2
Leather and leather products	1.2411	64.7
Printed matter and recorded media	1.8937	60.0
Textiles	1.5003	45.6
Pulp, paper and paper products	1.8640	44.8
Motor vehicles, trailers and semi-trailers	1.7108	20.7
Recreational, cultural and sporting services	1.8742	14.6
Wearing apparel; furs	1.2408	10.7
Other mining and quarrying products	1.8437	8.7
Products of agriculture, hunting and related services	1.6812	7.0
Fish and other fishing products; services incidental of fishing	1.9500	5.2