Chinese imports and labor market outcomes: evidence from Hungary

by

Boldizsár Juhász

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Supervisor: Gábor Békés

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Abstract

I study the relationship between increasing import competition from China and local labor market outcomes in Hungarian micro-regions between 1995 and 2007, looking at three separate 4-year-long time windows. I focus on changes in manufacturing and non-manufacturing employment rates and unemployment rates as outcome variables. I try to fix the potential bias of the original import exposure variable using an instrumental variable strategy recently proposed in the literature. I argue that the effects of total imports are ambiguous, and use only imports of consumption goods in most estimations, where the applied methodology actually works much better. I estimate a variety of models but do not find a statistically significant relationship between import exposure and these labor market outcomes in almost any of these.

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Chapter 1

Introduction

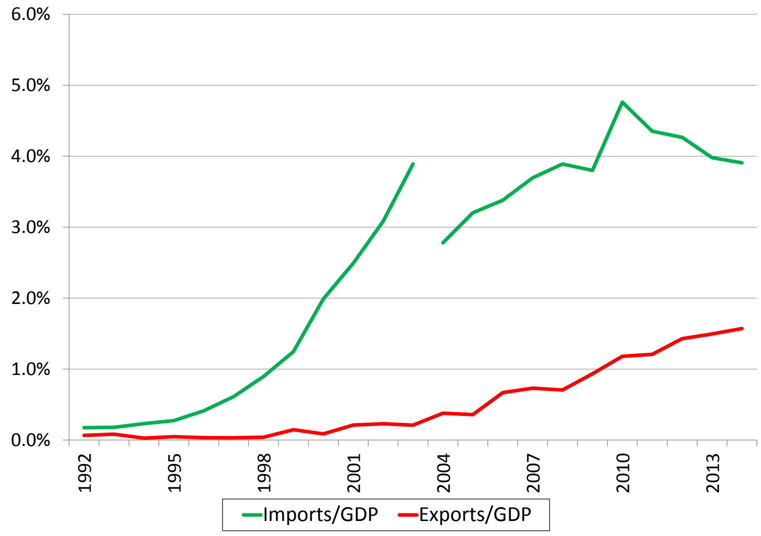
1.1 The rise of Chinese imports

The swift rise of China as a major power in international trade has been among the most important phenomena of the current wave of globalization or "the second golden age of trade" (Feenstra, 2010, p. 1). It is very likely that the exploding market share of Chinese imports caused some disruption in the economy of many countries. In my thesis, I analyse the labor market effects of Chinese imports in Hungary.

Just like many other high- and middle-income countries, Hungary has seen a dramatic increase in its trade flows with China. As shown in Figure 1.1, imports as a percent of GDP increased more than twenty-fold between 1992 and 2003, and by 70 percent between 2004 and the peak year of 2010.[1] From 2010 on, we see some decline in this indicator; still, in 2013, China was the fifth most important import partner of Hungary with a 5.4 percent share in total imports.[2] Trade between the two countries was highly imbalanced throughout this period, although Hun-

[1]The break from 2003 to 2004 is due to a change in data collection, to be discussed later.
[2]http://www.ksh.hu/docs/hun/xftp/idoszaki/kulker/kulker13.pdf p. 18.

Figure 1.1: Commodity trade flows of Hungary with China as percentage of GDP, 1992 to 2014



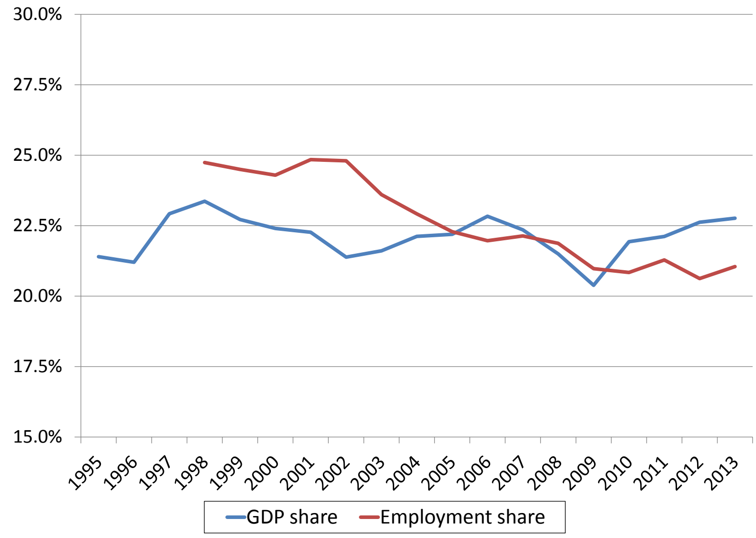
Source: Own calculation based on UN Comtrade and AMECO data. The cause of the break in the import data is explained in Section 3.2.

garian exports to China also rose steadily, from virtually zero levels to 1.6 percent of GDP by 2014.

1.2 Labor markets trends often associated with Chinese trade

Globalization in general, and especially the rapid growth of Chinese imports, are widely believed to be related–either as the primary cause or one contributing factor–to two important labor market trends in several high- and middle-income countries, first and foremost in the US: the decline of manufacturing employment and the increasing skill premium and wage inequality. Are these two also present in Hungary? The decline of manufacturing is there, but it is not particularly dramatic in an international comparison. Figure 1.2 shows that the share of manufacturing in employment declined approximately 4 percentage points between 2002 and 2010, from a level below 25 percent to one around 21 percent. On the other hand, the contribution of manufacturing to GDP was more stable: around 22 percent with some fluctuations. As for wage inequality,

Figure 1.2: The share of manufacturing in employment and GDP in Hungary, 1995 to 2013



Source: Hungarian CSO data

there was a well-documented sustained and large increase in the skill premium after the fall of communism (see Crino (2005), Kertesi and Köllő (2006)). In 2013, the average earnings of Hungarian adults aged 25-64 with tertiary education was 107 percent more than that of those with upper secondary or post-secondary non-tertiary education (OECD, 2013). This is the second largest such difference in the OECD; the average is only 57%. Other labor market indicators such as the unemployment rate also show a much better position for people with higher education.

So we can see that there were changes in the Hungarian labor market which *might* be due to rising imports from China. And what about the public perception of Chinese imports? The decline of some manufacturing sectors ('light industries') is often attributed to Chinese import competition. The common story is that domestic products could not compete with the much cheaper but also lower-quality Chinese goods–or, from a different point of view, Hungarian producers could not compete with Chinese ones due to the large gap in wages and labor standards. Quite often, the word 'dumping' is used in the context of Chinese imports; it is claimed that customs and taxes were avoided to some extent, and some sort of protection is called for[3].

This story could explain part of the two stylized facts described above, but it is certainly quite simplistic. First, the ability of the economy to reemploy the workers from these shrinking industries might be underestimated. Second, it does not give a complete picture of trade integration with China, which also includes import of inputs for production, and offshoring part of the production process to China, which can make firms more productive. From these issues, I am going to concentrate on that of importing production inputs (intermediate goods, industrial supplies or capital goods) versus consumer goods. Halpern, Koren and Szeidl (forthcoming) present evidence from a Hungarian firm panel that the use of imported inputs is related to higher productivity. This result suggests that, while the effect of importing consumer goods is quite straightforward–it is good for Hungarian consumers and bad for producers–, the general equilibrium effects of importing production inputs are much more ambiguous.

1.3 Imports or technology?

In the US, the main alternative candidate in the literature for the driving force of the evolution of the labor market is skill-biased technological change (for a synthesis of the literature see Feenstra (2010)). In fact, it is the dominant view that technology is the primary and trade is the secondary factor. Considering a number of simple trade models and conducting thought experiments, Krugman (2000) argues that trade volumes between low- and high-wage countries matter and current ones are not large enough to account for large distributional effects. Krugman (2008) also claims that though the effect of trade might have been higher in the 2000s than before but the basic argument made in the earlier paper still applies.

For now, let me put theory aside and say that the effect of imports from low-wage countries

[3] See mno.hu (2004) and vg.hu (2005), two articles from daily press, and alfoldicipo.hu (2010), the website of a surviving shoe manufacturer. I believe these reflect the public opinion quite well.

is, after all, an empirical question. Macroeconomic time series such as those presented above can make us suspect that there is a relationship between imports and some domestic outcome, but it is clearly impossible to measure any effect from these, even in a panel of countries. It is necessary to go beyond countries, the unit of analysis in classical trade theory. Several attempts have been made to quantify these effects using some sort of disaggregated data. In the following section, I present some of the methods proposed and the results.

1.4 Empirical evidence

First, it is possible to stick to macro-analysis and combine slightly disaggregated data with more advanced methods. Hiebert and Vansteenkiste (2010) use data on 12 US manufacturing industries from 1977 to 2003 and estimate GVAR models to analyze impulse responses to exogeneous shocks. The main result is that trade shocks on average have a negative effect on real compensation and a negligible effect on employment, and technology shocks have a more important impact on labor market outcomes than trade shocks. Another method which uses sectoral data is the factor content approach where the relative labor content of exports and imports are used to evaluate the effect of trade on the labor market (see Baily and Lawrence (2004)).

Second, some papers try to analyze the question using firm- or plant-level data. Here the basic idea is to regress firm-level outcome variables such as survival, wages, and number of employees on import penetration into the firm's industry and some control variables. Using US data from 1977 to 1997, Bernard, Jensen and Schott (2006) find that industry exposure is negatively associated with plant survival and growth, and positively associated with adjustment of the product mix and industry switching. They also find a disproportionate within-industry reallocation of manufacturing activity into capital-intensive plants. Álvarez and Opazo (2011) find a significant effect on the relative wages paid by plants in more exposed sectors in Chile, which is driven by the adjustment of smaller firms.

The only existing paper on the effect of Chinese imports on Hungary (Csermely, Harasztosi and Pellényi, 2012) also belongs to this branch of the literature. The authors investigate the effect of imports on four outcome variables: employment, average wage, productivity and firm exit. The only statistically significant effect is found to be on wages, which is negative in line with the expectations. They argue that the lack of significant average effects on the other outcome variables might arise from the different adjustment pattern across sectors. Sectoral level information suggests that more skill-intensive industries adjusted more successfully, while low-tech sectors were less able to compete, to some extent due to the large contemporaneous minimum wage increases. It is important to keep in mind the minimum wage increases as a potential source of confusion when trying to measure the impact of imports, even though more recent research (Harasztosi and Lindner, 2015) has suggested that the employment effects were quite small and most of the adjustment has actually happened through prices.

Third, Autor, Dorn and Hanson (2013) recently proposed a novel methodology which uses variation in import exposure across regions to measure the effects of Chinese imports. They propose an index to measure regional exposure to Chinese trade, constructed from industry-level US imports and sectoral employment composition of regions. They then argue that this measure is endogenous to labor market outcomes; however, the same measure constructed from Chinese imports to other high-income countries and lagged employment shares is a valid instrument for it. The results show regions more specialized in import-competing industries experience declining manufacturing employment, labor force participation and wages, as well as increasing unemployment and transfer benefits payments. According to a calculation using the estimated coefficients, approximately one-quarter of the observed aggregate decline in US manufacturing employment can be explained by Chinese import competition.

This methodology has since been applied to two large EU countries. Donoso, Martín and Minondo (2014) find that in Spain rising exposure to Chinese imports were only associated with a reallocation of some workers from manufacturing to other sectors; unemployment and participation rates were unaffected. Dauth, Findeisen and Suedekum (2014) argue that for Germany, the opening of Eastern European markets after the fall of the Iron Curtain was a shock of similar or greater importance than the rise of China. They include 'export exposure'–constructed and instrumented in a similar way as the measure of import exposure–in the regressions. The results show that regions more exposed to imports saw declining manufacturing and non-manufacturing employment rates, while export exposure had a positive effect of greater size on these outcomes. The authors estimate that trade integration with these two parts of the world has created close to half million jobs in Germany.

Another promising chapter in this literature tries to measure the effect of import competition on worker-level data. Autor et al. (2014) find that US workers who in 1991 worked in industries more exposed to Chinese import competition between 1992 and 2007, are affected in a number of ways such as decreasing cumulative earnings and increased risks of job loss. Colantone, Crinò and Ogliari (2015) use a unique British dataset to measure the effect of import competition on mental health. They find that an increase in import exposure has a large, positive, and very robust effect on mental distress.

Lacking access to suitable matched employer-employee data, I basically had to choose between a firm- and the region-level analysis. Both of these have their strengths and weaknesses. In a region-level analysis in a smaller country the number of observations can be quite small and problems such as multicollinearity can arise which is ruled out with a firm-level database with good coverage. On the other hand, in a firm-level analysis, what can be measured is only the most direct effects of import competition, and the number of firm-level variables that can be interesting as outcomes are quite limited. The regional analysis allows us to look at a larger set of outcome variables to examine both direct and indirect effects.

All in all, these two approaches seem to be somewhat complementary, and a firm-level analysis has already been conducted on Hungarian data. Hence, in this thesis I apply the second kind of analysis to Hungary, following the method proposed by Autor, Dorn and Hanson (2013) quite closely. My main departure from it is that I am going to attempt to remove the ambiguous impact of imported inputs by conducting the analysis with measures of import exposure to consumer goods, too. The rest of the thesis is organized as follows. Chapter 2 explains the methodology in more detail and collects some considerations on how to implement it to Hungarian data. Chapter 3 introduces the various sources of data I use and presents some descriptive statistics. Chapter 4 presents the main results and robustness checks, and Chapter 5 concludes and proposes directions for future research.

Chapter 2

Theory and empirical strategy

2.1 From theoretical model to measuring import exposure

International trade and domestic labor market outcomes are linked in several model families of international trade. However, measuring exposure to trade is not a trivial issue at all, especially on regional rather than firm-level. To motivate the construction of the import exposure variable and the empirical strategy, Autor, Dorn and Hanson (2013) build a simple model with a gravity structure of trade. They consider economies with a traded and non-traded sector, with the traded one consisting of several industries with monopolistic competition and a large number of firms, and assume differences in industry-level labor productivities across countries.

Suppose there is a positive shock to China's capability to export, through productivity growth and/or reduction of trade costs and barriers. It is reasonable to assume that such shocks were in fact the main cause of China's export growth in the 1990s and 2000s, rather than demand-side shocks in other countries. The shock has an impact on regions of the other country through two channels: increasing competition on markets where the regions sells its traded goods, and increasing demand for these goods in China.

In this model, the effects of the shock depend crucially on the balance of trade between China and the other country. With balanced trade, labor demand is reduced in regions more exposed to import competition and increased in ones which enjoy growing Chinese demand for their goods more. Labor reallocation happens only between traded-sector industries. On the other hand, if trade is imbalanced, the size of the traded sector might change, too. The other margin of adjustment, wages, might change in both scenarios. Two further restrictions are needed to arrive at the measure of import exposure. First, only one channel from the model, import competition in the domestic market is considered; exports to China and competition in third countries is ignored. Note that this might be much more restrictive for Hungary than for the US, but finding a way to measure how Hungarian and Chinese exports competed in Germany, for instance, is beyond the scope of this paper. Second, the share of trade imbalance in total expenditure is taken to be uniform across regions.

Based on the model, a good measure of import exposure of the local labor market is the change in Chinese imports per worker, with imports apportioned to regions by their shares in total domestic industry employment, i.e.

$$\Delta IE_{it}^{hu} = \sum_j \frac{L_{ijt}}{L_{jt}^{hu}} \frac{\Delta M_{jt}^{cn \to hu}}{L_{it}} , \tag{2.1}$$

where L_{ijt} and L_{jt}^{hu} are employment in region i and Hungary, respectively, in industry j at the start of the period (year t); L_{it} is total employment in region i at year t, and $\Delta M_{jt}^{cn \to hu}$ is the change in Chinese imports to Hungary in industry j between t and $t+n$. Variation in ΔIE_{it}^{hu} comes from two sources: share of manufacturing and non-manufacturing in employment, and the industry composition of manufacturing employment.

2.2 Basic empirical model and potential bias

I use the measure derived above to fit models of the form

$$\Delta\,\text{Labor market outcome}_{it} = \alpha + \beta_1\,\Delta IE_{it}^{hu} + \mathbf{X}_{it}^{'}\beta_2 + e_{it}\ , \tag{2.2}$$

where Δs denote changes over multi-year time windows, as these effects are probably not immediate enough to be identified from year-to-year differences. This is somewhat similar to a first-differenced estimation except that ΔIE_{it}^{hu} is not a real first difference, being defined in a way that it cannot be written as $IE_{it}^{hu} - IE_{it+1}^{hu}$, and I allow X_{it} to include both first differences and levels. The well-known strength of such specifications is that the effect of time invariant factors affecting the outcome are differenced out.[1]

There is, however, a quite serious threat to exogeneity in this specification. Unobserved product demand shocks in Hungary might be positively correlated to both employment and Chinese imports. This would cause $\hat{\beta}_1$ to be biased towards zero in all cases because the domestic demand shock has effects of opposite site than imports on the outcome variables (see Figure 2.1).

2.3 Instrumental variable strategy

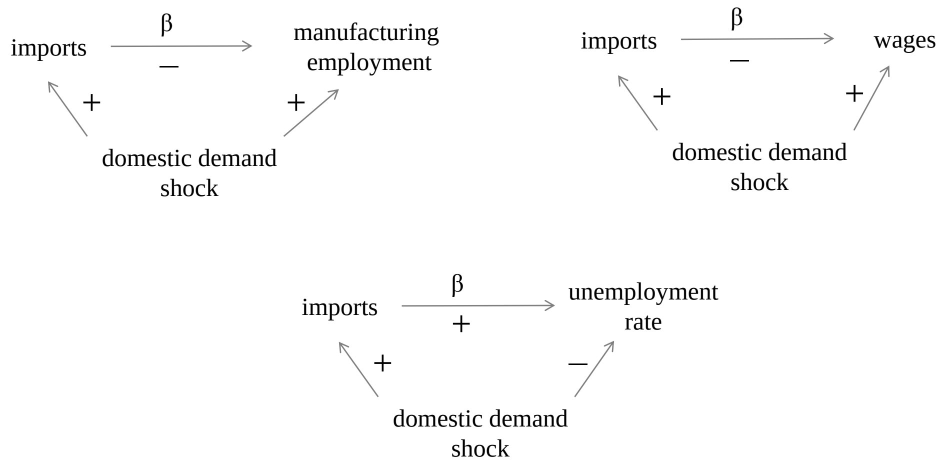
To deal with this potential bias, I am going to instrument the change in import exposure variable with the expression

$$\Delta IE_{it}^{ot} = \sum_j \frac{L_{ijt-1}}{L_{jt-1}^{hu}} \frac{\Delta M_{jt}^{cn\to ot}}{L_{it-1}}\ . \tag{2.3}$$

Here, all employment variables are lagged. The use of lagged employment variables tries to fix the problem that the growth of Chinese imports can be anticipated to some extent, and some of

[1] I would like to stress once more that this is not a pure FD-estimation, and I am going to refer to it as OLS in Section 4.

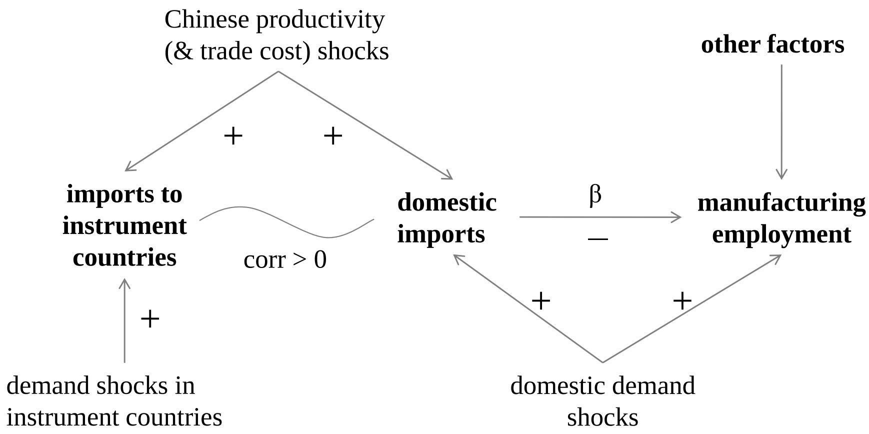
Figure 2.1: Potential bias in basic specification: $\hat{\beta}$s are biased towards zero in each case. Observed variables are in bold.



the adjustment in the composition of employment can take place in advance. The more important change is replacing $\Delta M_{jt}^{cn\to hu}$ with $\Delta M_{jt}^{cn\to ot}$, the contemporaneous industry-level imports from China to other countries. With this instrument, the supply-driven component of Chinese imports might be identified in the first stage regression. The key condition is that product demand shocks between Hungary and the instrument country/countries be uncorrelated. In this case, the correlation between imports to the different markets is driven solely by China. For clarification, a sketch of this strategy is also shown in Figure 2.2.

The choice of the countries to be used for the instrument is quite important. This is most thoroughly considered in Dauth, Findeisen and Suedekum (2014). They argue that the best candidates for the construction of 2.3 so that it is both valid and satisfies the exclusion restriction are countries with a similar income level to the home country but without a high level of integration with it (for example, neighboring countries or countries in the same monetary union are excluded). Finding these for Hungary, an upper middle income transition economy is not trivial. Other transition economies have seen too many common shocks with Hungary even if not neighboring. On the other hand, middle income countries outside Europe, such as Latin American ones, are too different from Hungary. I choose the three lowest income EU15 members, Spain,

Figure 2.2: Channels of causality according to the IV strategy. Observed variables are in bold.



Portugal, and Greece as candidates. Then, in Section 3.2, I argue that I use only the Spanish data due to quality issues. Even though the variable constructed from it turns out to be a weak instrument in some specifications, at least it is quite plausible that the exogeneity condition holds.

2.4 Further considerations for Hungary

The countries where this methodology was applied so far, the US, Germany, and Spain, were all quite stable developed economies in this period. For these countries, the rapid growth of Chinese imports was one of the few major shocks in this period. In contrast, Hungary was a transition country experiencing a number of contemporaneous shocks. The economy went through a deep transformation, there were large changes in employment structure and other labor market outcomes that were not due to trade with China. This implies that estimating 2.2 for more periods as a stacked first difference model, with time dummies added to capture the effect of the general macroeconomic environment, does not seem to be a good idea for Hungary, even though the number of observations can be effectively doubled or trebled with this method, it . Instead, I am going to estimate 2.2 separately for three four-year long time windows.

Chapter 3

Data

3.1 Unit of analysis

The ideal geographic unit for such an analysis is one which can be called a 'local labor market'. Autor, Dorn and Hanson (2013) use 722 commuting zones, clusters consisting of one or a few US counties with strong commuting ties within and weak commuting ties outside the group. Dauth, Findeisen and Suedekum (2014) conduct the analysis both at the level of 413 German counties and 147 'functional labor markets', which are based on commuting distances. Donoso, Martín and Minondo (2014) use only administrative units–the 50 provinces of Spain–arguing that these are adequate as the metropolitan areas of Spain with very high labor linkages mostly correspond to province capitals.

Unfortunately, commuting zones have not been delineated in Hungary, and doing this is beyond the scope of this thesis. As the best available option, I use the 175 micro-regions[1], which are a statistical unit for regional development, and correspond to the NUTS-4 level. These might

[1]See `https://www.ksh.hu/regional_atlas_microregions?lang=en`.

be too small if we consider their number and the size of Hungary relative to the countries above but perhaps the transport opportunities of the average Hungarian worker are also worse. However, I claim that even if some of the labor market adjustment can take the form of commuting out of the micro-region, we should still see an effect on *some* of the outcome variables. For example, if Chinese import exposure does have a large negative impact on manufacturing employment but most displaced workers can commute to less-affected micro-regions nearby, we can expect a large effect on the manufacturing share in employment but a small or zero effect on the unemployment rate. It is important to keep in mind this aspect when interpreting the results. All in all, I consider this (i.e., not conducting the analysis at the optimal level) to be a serious issue, and I basically try to handle it by always looking at a set of outcome variables at the same time. As a robustness check, I also carry out the analysis on 73 larger units (see Subsection 4.3.3).

I combine data from three different sources for the empirical analysis. While the unit of the analysis is micro-regions, none of the original data sets are at this level: the first one is a product-level, the second one is a firm-level, and the third one is a municipality-level data set.

3.2 Trade data

Trade data comes from the United Nations Commodity Trade Statistics Database (Comtrade)[2]. Imports from China to Hungary at the six-digit Harmonized System (HS) product level are available from 1992 to 2014. However, there was an important change in the definition of partner country over this period: from 1992 to 2003, partner was defined as country of origin, while from 2004 on, it has been defined as country of consignment[3]. This change causes significant

[2]See `http://comtrade.un.org/db/default.aspx`.

[3]Actually, the metadata of the Comtrade database claims that the country of consignment definition was also used between 2000 and 2002 but this seems to be dubious according to Figure 1.1. As a check, I looked at the time series of total imports from the Netherlands, a country with large transit trade. Here a large *positive* jump can be seen from 2003 to 2004, with imports almost trebling, and no extreme changes in any other year. This confirms that the metadata is incorrect.

breaks in the time series for countries whose imports often reach Hungary indirectly. As can be seen in Figure 1.1, this is also the case for China: contrast the 13 percent drop from 2003 to 2004 to the average growth rates of 52% and 22% in the three years before and after the change, respectively. For my analysis, this break in the trade data means that I must always use data before and after 2004 separately.

Interestingly, while the methodological change in the Hungarian data was due to accession to the EU (Csermely, Harasztosi and Pellényi, 2012), there were quite different revisions in the three Southern European countries which are my original candidates to construct the instrumental variable according to the Comtrade metadata[4]. Again, correctness of the metadata is dubious for Greece and Portugal (see Figure B.1 in the Appendix). What we can certainly see is that going to more disaggregated product levels, the values from the two smaller countries usually seem more noisy and around one magnitude smaller than the Spanish ones (as an illustration, see Figure B.2 in the Appendix). While adding up data from several countries could usually make for a better instrument, in this case it does not seem to be a good idea: the two smaller countries would just give additional noise to the Spanish data, which is is the smoothest and internally consistent for sure. Hence, I opt to construct the instrumental variable with Spanish data only.

3.3 Firm-level data

The second source of data is an administrative database provided by the National Tax and Customs Administration of Hungary (NTCA; NAV, previously APEH in Hungarian) through the Hungarian Central Statistical Office (CSO). This dataset covers the whole population of firms with double-entry bookkeeping. It includes variables from the balance sheet and income state-

[4]Spain used a country of origin classification until 2008 and switched to country of consignment only for intra-EU imports in 2009. Portugal used the former definition until 1999, in 2007, 2012 and 2013, and the latter in the rest of the years. Finally, Greece switched from a country of consignment to a country of origin/consignment for intra-EU definition in 2000.

ment of firms as well as other basic indicators such as industry, location of headquarters, and number of employees. It is available from 1992 to 2013 and firms have a unique identifier so that they can be followed over time and matched to other firm-level datasets of the CSO. Actually, the headquarter variable itself had been matched to this database from the Business Register by the CSO and does not have full coverage, especially for the early 1990s. Note that this is by nature an unbalanced panel where appearance in and disappearance from the data mean firm entry and exit, respectively.

I use this dataset to calculate the employment components of the import penetration index (see the next section), and also a number of other variables. FDI stock control variables, and some of the left-hand side variables (manufacturing share in employment, manufacturing and non-manufacturing employment share in working-age population, average wages and average manufacturing wages). Labor market variables generated from this database are not perfect because they exclude some forms of micro-enterprises and self-employment, and public service. They can be considered a sort of business employment data. So, it can be argued that the manufacturing employment variables calculated from it are quite good, while the non-manufacturing ones not really. Its main advantage and the ultimate reason for using it is that it can be used to calculate more disaggregated industry-level employment than available in regional databases. Due to issues about the quality of early 1990s data, I use only one-year lagged employment to construct the instrument. I match firms to micro-regions based on the municipality of their headquarter. The headquarter data is clearly an imperfect measure of actual location of production and employment but in the case of manufacturing, it is actually a quite good one (Békés and Harasztosi (2013)).

3.4 Product codes and industry codes

In the firm panel, I use tables provided by CSO to harmonize 4-digit industry codes from the 1992 and 1998 Hungarian TEÁOR classification (equivalent to NACE Rev. 1 at the 2-digit level and completely, repectively) to the 2003 TEÁOR codes, which are fully equivalent to NACE Rev. 1.1.

The import data needs to be converted from product- to industry-level to calculate the measure of import penetration given in 2.1 and the instrument given in 2.3. I downloaded all trade data in HS1992 classification, at 6-digit product codes, the most disaggregated level available. Then I use a 1993 (the earliest available) CN-to-Prodcom conversion table from Eurostat's RAMON Server[5] to create a HS1992-to-NACE1 conversion table. I use the facts that HS did not change at the 6-digit level from 1992 to 1993, the 8-digit CN is equivalent to HS at the 6-digit level, and the first 4 digits of 8-digit Prodcom codes stand for NACE industries. The conversion table I obtain contains some products assigned to more than one industries; in these cases, I use equal weights to share the import value of the product. Since Prodcom includes only industrial production, other kinds of imports (such as Chinese food ingredients) are dropped in this step. After the conversion I harmonize the industry-level imports to NACE Rev. 1.1 with the same tables which I used for the firm panel. For an example, see Table A.1 in the Appendix.

After the conversion and harmonizations, I switch from 4- to 3-digit industry codes to reduce problems associated with this procedure[6]. Now the L and M components of 2.1 and 2.3 can be matched and the import exposure measures can be calculated.

For reasons already mentioned in Section 1.2, I am going to use exposure to consumer good imports rather than exposure to total imports in many specifications. These are calculated in the

[5] http://ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl=LST_REL

[6] For example, equal weighting at the product-to-industry conversion can be problematic, but many times the industries assigned to one product are part of the same 3-digit category.

following way: a HS1992-to-BEC (Broad Economic Categories) conversion table[7] is merged to the original product level import data, and all values of products belonging to categories other than 6 (Consumer goods not elsewhere specified)[8] are replaced with zeros. This is followed by the same conversion and aggregation steps as described above.

3.5 Municipality-level data

I also use some demographic and labor market variables from CSO's T-STAR database. This database contains a plethora of municipality-level indicators but several are available only for a few years. Unemployment data, for instance, is quite good, while industry-level employment can be constructed from the balance sheet database much better. Most of the variables are measured in absolute numbers, so they can be easily aggregated to the micro-region level to calculate percentages. Municipal mergers and dissolutions cause no problem as the old and new units can be matched to the same micro-region.

I use total population and total working-age population from this dataset to create per capita and population share variables where it is necessary, and unemployed population to calculate unemployment rate as a dependent variable.

3.6 Outliers

There is one micro-region (Tab, in Somogy county), which produces extremely high import exposure measures in two time windows, and extremely low in one. This was apparently caused by the presence of a large, dominant plant. In the early stage of my work I made more attempts at improving correlations between the import exposure measure and some of the outcome variables

[7]Available at `http://wits.worldbank.org/product_concordance.html`
[8]The complete BEC classification can be found here: http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=10

but in the end these were judged to be too arbitrary, and only this really extreme micro-region was dropped from the sample. Besides the Tab micro-region, I also drop Budapest and the neighboring micro-regions in a robustness check, reducing sample size to 164 (see Section 4.3.1).

Chapter 4

Results

In this section, I present the estimation results of the models presented in Chapter 2. I first focus on three employment type outcomes, manufacturing and non-manufacturing employment, and unemployment. Remember that what makes it a good idea to present the estimated effects on these together rather than organize this chapter by outcome variables is that the analysis is not conducted at the most appropriate level (a local labor market, such as a commuting zone), as argued in 3.1.

Due to the break in Hungarian trade data between 2003 and 2004, described in Section 3.2, and the argument made in Section 2.4 about time window length, I estimate equations of the form 2.2 for 1995-1999 and 1999-2003 separately, both with total Chinese imports and with imported consumer goods. Next, I check in which cases the proposed instrumental variable strategy works well, and compare the 2SLS results to the OLS ones. I also estimate the reduced form version of the 2SLS for 2003-2007 where the 2SLS works well for the previous time window. Then I perform three robustness checks. First, I estimate some of the regressions above with Budapest and the neighboring micro-regions omitted from the sample. Second, I estimate them with data on exposure to imports from a larger set of Asian developing countries. Third, I estimate some equations after merging most micro-regions into somewhat larger geographical units. The motivations for these checks are explained in each subsection. Finally, I briefly report on the estimated effects on wage outcomes.

4.1 Results with total imports

I first estimate equations of the form 2.2. The results are presented in Tables 4.1 and 4.2. Columns (1)-(3), (4)-(6), and (7)-(9) show the estimated effect on the three baseline dependent variables, the change in the manufacturing and non-manufacturing employment share of working-age population, and the change in the unemployment rate, respectively. All three are measured in percentage points, being the $(t+4)-t$ differences of variables in percents. My general expectation is the following employment adjustment pattern: the effect of the change in import exposure is negative on manufacturing employment, positive on unemployment, and the effect on non-manufacturing employment can be of any sign (labor supply in these sectors might increase, but demand for their services might decrease).

For each left-hand side variable, the first column shows the results from a simple regression on the import exposure measure. In the next column, a control is added for the start-of-the-period share of manufacturing within employment in the micro-region. The concern this addresses is that part of the variation in the import exposure variable comes from manufacturing share rather than manufacturing industry mix. So, if there was some overall underlying trend in Hungarian manufacturing (e.g. a general decline, or cross-region divergence or convergence) that is not due to import competition from China, its effect would be captured in the coefficient of import exposure. In the third column, I add the change in manufacturing FDI per worker, the last reasonable control from the data at my disposal. I add this because FDI inflow was an important force in the Hungarian economy after 1990, and despite some concerns about its endogeneity[1]. I use robust

[1]The basic concern is that when FDI selects its location endogeneously. Still, I think not including this variable

standard errors clustered at the NUTS-2 level regions to account for potential spatial autocorrelation across micro-regions. Using counties (equivalent to NUTS-3) as an alternative level of clustering yields very similar standard errors, this choice almost never matters for inference. All models are weighted by the micro-regions' share in national population at the start of the period.

Even though a sound argument was made in Section 2.2 that the coefficients in these regressions are biased towards zero, it is still surprising that the estimated coefficient of import exposure is not statistically significantly different from zero in any of these specifications, even at the .10 level. The other potential problem with this estimation was also discussed earlier, in Section 1.2: the effect of importing production inputs and final consumer goods can be very different.

Table 4.1: Exposure to total Chinese imports and employment outcomes, OLS, 1995-1999

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	2.018	3.241	2.476	1.656	2.132	2.501	-0.939	-0.955	-1.040
	(1.838)	(1.938)	(1.629)	(1.596)	(1.727)	(1.974)	(0.624)	(0.645)	(0.652)
manufacturing employment t_0		-0.110	-0.114		-0.0427	-0.0407		0.00143	0.000953
		(0.0608)	(0.0614)		(0.0362)	(0.0307)		(0.00850)	(0.00735)
Δ manufacturing FDI per worker			0.0139*			-0.00669			0.00155
			(0.00672)			(0.00419)			(0.00120)
Constant	0.353	3.432	3.624	2.384*	3.583	3.490	-1.341***	-1.382**	-1.360**
	(1.106)	(2.610)	(2.289)	(1.163)	(2.087)	(1.870)	(0.304)	(0.471)	(0.449)
Observations	174	174	174	174	174	174	174	174	174
R-squared	0.007	0.058	0.120	0.014	0.036	0.077	0.043	0.043	0.066

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab. t_0 variables represent 1995 values, while Δ variables represent 1995 to 1999 changes, except for Δ import exposure, a hybrid variable constructed from 1995 level and 1995 to 1999 change variables. The import exposure variable is calculated from total Chinese imports to Hungary. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 1995 share of national population.

A natural next step would be to try to fix only the first of these issues, and conduct the 2SLS analysis with total Chinese imports in the exposure measure. Unfortunately, it turns out that the

would be a waste of the data at hand. The point is that these columns should be interpreted with extra caution and should not be automatically considered the preferred estimates. Dealing with the endogeneity in this variable is beyond the scope of this thesis.

Table 4.2: Exposure to total Chinese imports and employment outcomes, OLS, 1999-2003

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-0.378	-0.185	-0.301	0.216	0.559	0.556	-0.00687	0.00461	0.0220
	(0.485)	(0.460)	(0.502)	(0.155)	(0.354)	(0.383)	(0.0441)	(0.0564)	(0.0523)
manufacturing		-0.0600*	-0.0665*		-0.107	-0.107		-0.00356	-0.00259
employment t_0		(0.0301)	(0.0302)		(0.0872)	(0.0860)		(0.00689)	(0.00740)
Δ manufacturing			0.00142			4.27e-05			-0.000212
FDI per worker			(0.000920)			(0.000401)			(0.000143)
Constant	-0.860	0.833	1.055	1.874	4.882	4.889	-0.667***	-0.567**	-0.600**
	(0.671)	(1.440)	(1.444)	(1.467)	(3.563)	(3.525)	(0.177)	(0.221)	(0.236)
Observations	174	174	174	174	174	174	174	174	174
R-squared	0.006	0.023	0.034	0.003	0.089	0.089	0.000	0.002	0.009

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab. t_0 variables represent 1999 values, while Δ variables represent 1999 to 2003 changes, except for Δ import exposure, a hybrid variable constructed from 1999 level and 1999 to 2003 change variables. The import exposure variable is calculated from total Chinese imports to Hungary. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 1999 share of national population.

instruments generated using import data from the carefully chosen third country, Spain are not strong enough for a credible second stage. The estimated coefficient of the exogenous import exposure measure is significant only at the .05 level for both time windows, and the highest first-stage F statistic is 5.9. The reduced form versions of these regressions also clearly show that instrumenting does not help here. The reduced form results for 1999-2003, the time window with the relatively more successful first stage are reported in Table A.2 of the Appendix.

4.2 Results with consumer good imports

I proceed by looking at the effect of exposure to consumer good imports only, i.e. using the variants of 2.1 and 2.3 calculated from the imports of consumer goods only, as explained at the end of Section 3.4. It turns out that the first stage of the 2SLS estimation works much better with the new import exposure variables. However, the first stage for the 1995-1999 time window is still not convincing. I focus on the results for 1999-2003.

From the 1999-2003 time window, I report the OLS results (i.e., the equivalent of Table 4.2 with consumer good import exposure), and both stages of the 2SLS estimation. The OLS results in Table 4.3 show that, contrary to my expectations, simply removing production inputs from the import exposure variable does not help us at all to find adjustment patterns in employment that are at least statistically significant.

Table 4.3: Exposure to Chinese consumer good imports and employment outcomes, OLS, 1999-2003

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-2.253	0.143	0.00964	-3.201	0.185	0.145	-0.595	-0.540	-0.519
	(2.049)	(2.359)	(2.343)	(3.454)	(1.265)	(1.249)	(0.312)	(0.442)	(0.450)
manufacturing employment t_0		-0.0654	-0.0733		-0.0925	-0.0948		-0.00150	-0.000264
		(0.0380)	(0.0394)		(0.0811)	(0.0825)		(0.00645)	(0.00729)
Δ manufacturing FDI per worker			0.00124			0.000371**			-0.000194
			(0.000829)			(0.000145)			(0.000149)
Constant	-0.956*	0.835	1.026	2.354	4.886	4.944	-0.616***	-0.575**	-0.605**
	(0.473)	(1.484)	(1.501)	(1.768)	(3.676)	(3.711)	(0.154)	(0.221)	(0.234)
Observations	174	174	174	174	174	174	174	174	174
R-squared	0.003	0.022	0.030	0.008	0.070	0.071	0.006	0.006	0.013

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab. t_0 variables represent 1999 values, while Δ variables represent 1999 to 2003 changes, except for Δ import exposure, a hybrid variable constructed from 1999 level and 1999 to 2003 change variables. The import exposure variable is calculated from Chinese consumer good imports to Hungary. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 1999 share of national population.

Table 4.4 presents the first stage results. It can be seen that here, at last, a strong and very robust relationship is found between the import exposure measures constructed from Hungarian and Spanish trade data. This suggests that imports of consumer goods from China changed in a very similar way in Spain and Hungary over this period (but the same is not true for overall imports). It seems quite reasonable that the channel through which these two are correlated are exogenous improvements in China's capability to export.

The nice results from the first stage make the 2SLS presented in table 4.5 my preferred set of estimations so far. How do these results compare to the OLS shown above? In the case of manufacturing employment and unemployment as dependent variables, the direction in which the

Table 4.4: Exposure to Chinese consumer good imports and employment outcomes, 2SLS 1st stage, 1999-2003

Dependent variable	Δ import exposure		
	(1)	(2)	(3)
Δ import exposure instrument	0.156***	0.156***	0.157***
	(0.016)	(0.018)	(0.017)
Observations	174	174	174
R-squared	0.77	0.77	0.78
F-statistic	90.16	52.75	48.36

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: First stage estimates for Table 4.5, explained in the notes for that table.

coefficients of the key explanatory variables change corresponds to the claims made in Section 2.2 (no claim was made about the effect on non-manufacturing employment). However, the magnitude of these changes is quite small. Again, the estimated effect of import exposure is not statistically significantly different from zero throughout these equations.

While it is a problem that a similar set of demographic, employment and technological controls are not available as in the corresponding regressions of Autor, Dorn and Hanson (2013)[2], it should be noted that in that paper, those did not change the estimates of the key variables qualitatively, and also, not much quantitatively.

Due to the strong first stage results for the 1999-2003 time window, it makes sense to estimate the reduced form equation for 2003-2007, where OLS and 2SLS are not possible due to the change in measurement of imports to Hungary. Still, results, presented in Table 4.6 should be interpreted carefully. We can see that the estimated coefficient of the import exposure instrument is statistically significant with the unemployment rate as a dependent variable (but only at the 0.1

[2]The percentage of college-educated population and foreign-born population, the percentage of employment among women, and the percentage of employment in routine occupations, and an average offshorability index of occupations, all at the start of the period.

Table 4.5: Exposure to Chinese consumer good imports and employment outcomes, 2SLS 2nd stage, 1999-2003

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-5.559	-3.036	-2.741	-6.313	-2.432	-2.340	-0.339	-0.215	-0.261
	(4.064)	(4.085)	(4.085)	(5.489)	(2.316)	(2.195)	(0.672)	(0.681)	(0.635)
manufacturing		-0.0540	-0.0636*		-0.0831	-0.0860		-0.00267	-0.00118
employment t_0		(0.0358)	(0.0381)		(0.0709)	(0.0717)		(0.00480)	(0.00552)
Δ manufacturing			0.00126			0.000393**			-0.000196
FDI per worker			(0.000826)			(0.000184)			(0.000142)
Constant	-0.643	0.784	0.986	2.649	4.844	4.907	-0.641***	-0.570***	-0.602***
	(0.577)	(1.353)	(1.374)	(1.779)	(3.374)	(3.389)	(0.123)	(0.203)	(0.215)
Observations	174	174	174	174	174	174	174	174	174

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab. t_0 variables represent 1999 values, while Δ variables represent 1999 to 2003 changes, except for Δ import exposure, a hybrid variable constructed from 1999 level and 1999 to 2003 change variables. The import exposure variable is calculated from Chinese consumer good imports to Hungary. In this table, it is instrumented with a similar variable calculated from 1998 level variables and imports to Spain instead of Hungary, and the controls indicated in each column. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 1999 share of national population.

level in columns (7) and (9) and at the 0.05 level in column (8)), and this is quite robust across the three specifications–the effect of the two controls is negligible. The size of the effect is quite small but non-trivial: in a micro-region, where import exposure as measured here increased one standard deviation (0.76) more, the unemployment rate increased approximately 0.22 percentage points more on average (while the average unemployment rate was 5.99 percent in 2003 and 7.34 in 2007).

4.3 Robustness checks

4.3.1 Omitting Budapest metropolitan area

In this section, I present results from a sample without Budapest and the neighboring 9 micro-regions. Omitting Budapest from a region-level analysis in Hungary is a quite reasonable and common practice. Budapest is a relatively large capital compared to the country: its metropolitan

Table 4.6: Exposure to Chinese consumer good imports and employment outcomes, reduced form, 2003-2007

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-0.633	-0.207	-0.261	-0.658	-0.341	-0.293	0.282*	0.292**	0.285*
instrument	(0.333)	(0.358)	(0.347)	(0.555)	(0.268)	(0.239)	(0.122)	(0.117)	(0.123)
manufacturing		-0.0976***	-0.0893**		-0.0727	-0.0801		-0.00233	-0.00121
employment t_0		(0.0225)	(0.0284)		(0.0623)	(0.0682)		(0.0165)	(0.0182)
Δ manufacturing			0.00142***			-0.00128***			0.000192
FDI per worker			(0.000303)			(0.000200)			(0.000191)
Constant	-1.261	0.914	0.833	3.899	5.519	5.592	0.961*	1.013	1.002
	(0.872)	(1.409)	(1.459)	(2.206)	(3.402)	(3.449)	(0.480)	(0.614)	(0.623)
Observations	174	174	174	174	174	174	174	174	174
R-squared	0.032	0.079	0.091	0.066	0.117	0.135	0.086	0.086	0.089

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab. t_0 variables represent 2003 values, while Δ variables represent 2003 to 2007 changes, except for Δ import exposure instrument, a hybrid variable constructed from 2002 level and 2003 to 2007 change variables. The import exposure variable is calculated from Chinese consumer good imports to Spain. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 2003 share of national population.

area[3] accounts for almost one quarter of the population of Hungary (KSH, 2007). It is probably subject to somewhat different shocks than the rest of the country. Hence, it could be argued that a robust relationship should hold without these regions in the sample. While these 10 micro-regions are not major outliers in the variables used, they could still influence the results in unexpected ways due to all models being weighted by shares in national population. (An alternative check could be estimating unweighted models.)

Before proceeding to the results, let me make a short comment on whose 'robustness' I actually check here. I think that both the general statistical insignificance of the results and the few statistically significant ones are worth checking in slightly modified setups to be able to come to a more sound conclusion.

Due to the well-known concerns with the other estimations, I focus on reproducing and comparing my preferred tables. The first stage performs well in the same cases as with the full

[3]This is not exactly identical to the area I drop here (it is somewhat larger).

sample. I present the 2SLS results for 1999-2003 with import exposure to consumer goods in Table 4.7. The results are qualitatively similar to the ones on the full sample (Table 4.5). A single coefficient of interest is statistically significant, at the 0.1 level (in the following, I will not discuss such minor changes as improvements). The statistically significant positive effect on unemployment from the 2003-2007 reduced form estimates (Table 4.6) disappears in this sample. This output is reported in the Appendix (Table A.3).

Table 4.7: Exposure to Chinese consumer good imports and employment outcomes, without Budapest metropolitan area, 2SLS 2nd stage, 1999-2003

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-7.465	-4.179	-4.863	-0.580	-1.310	-1.584*	-0.302	-0.181	-0.109
	(4.790)	(4.655)	(4.411)	(0.778)	(1.191)	(0.900)	(0.699)	(0.732)	(0.745)
manufacturing		-0.0818**	-0.0888**		0.0182	0.0154		-0.00302	-0.00229
employment t_0		(0.0375)	(0.0434)		(0.0148)	(0.0125)		(0.00673)	(0.00760)
Δ manufacturing			0.00431**			0.00172***			-0.000449
FDI per worker			(0.00188)			(0.000366)			(0.000397)
Constant	-0.0791	2.330*	2.511*	0.505	-0.0307	0.0420	-0.629***	-0.540*	-0.559*
	(0.531)	(1.258)	(1.335)	(0.358)	(0.532)	(0.531)	(0.167)	(0.324)	(0.336)
Observations	164	164	164	164	164	164	164	164	164

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab, Budapest and all micro-regions neighboring Budapest. t_0 variables represent 1999 values, while Δ variables represent 1999 to 2003 changes, except for Δ import exposure, a hybrid variable constructed from 1999 level and 1999 to 2003 change variables. The import exposure variable is calculated from Chinese consumer good imports to Hungary. In this table, it is instrumented with a similar variable calculated from 1998 level variables and imports to Spain instead of Hungary, and the controls indicated in each column. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 1999 share of national population.

4.3.2 Imports from a set of Asian low-wage countries

While China is undoubtedly the protagonist in the story of the import competition from low wage countries, there is no reason to assume that increasing imports from other developing countries should have a different effect on local labor markets. In this section, I reestimate some equations with exposure to imports from 12 Asian developing countries[4]. China dominates this group in terms of total import volumes, but the product mixes of the countries are somewhat different, so the import exposure variables are different enough to make this interesting.

With the exposure to total imports measures, both the OLS and the 2SLS produce statistically non-significant coefficients. The results are not reported. Instead, I focus again on comparing the preferred estimates to their baseline equivalents. Appendix table A.4 and Table 4.8 report the results from the two stages of the 1999-2003 2SLS estimates. We can see that the first stage is similarly strong and robust as with the Chinese data. The estimated effects on the first two dependent variables all move downwards compared to Table 4.5 (i.e. they are negative numbers of greater absolute value), while the estimated effects on unemployment move towards zero. The results are qualitatively unchanged. The reduced form estimates for 2003-2007, shown in Table 4.9 are also quite similar to their baseline equivalents in 4.6.

4.3.3 Merging micro-regions

As a third robustness check, I conduct the analysis on 73 larger geographical units, which I create by merging some neighboring micro-regions in what can be considered a primitive procedure to delineate commuting zones[5]. This attempt does not prove successful: these artificial units are probably still very different from actual commuting zones, and the significance levels decrease further due to the reduction of the sample size. The results are unreported.

[4]Besides China, I include Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Pakistan, the Philippines, Thailand, and Vietnam.

[5]I merge the micro-regions with the smallest population with a high priority. I also merge every neighboring micro-region to Budapest. All mergers are within NUTS-2 regions, and almost all were within counties. Almost all zones consist of 2, 3, or 4 micro-regions.

Table 4.8: Exposure to consumer good imports from 11 Asian countries and employment outcomes, 2SLS 2nd stage, 1999-2003

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-7.078*	-5.037	-4.505	-7.628	-4.015	-3.849	-0.202	-0.0409	-0.124
	(4.193)	(4.513)	(4.515)	(6.501)	(3.421)	(3.306)	(0.861)	(0.981)	(0.907)
manufacturing		-0.0412	-0.0522		-0.0729	-0.0763		-0.00325	-0.00152
employment t_0		(0.0372)	(0.0406)		(0.0657)	(0.0664)		(0.00531)	(0.00588)
Δ manufacturing			0.00126			0.000395*			-0.000198
FDI per worker			(0.000860)			(0.000218)			(0.000143)
Constant	-0.221	0.776	0.979	3.073	4.838	4.901	-0.646***	-0.567***	-0.599***
	(0.709)	(1.354)	(1.378)	(2.063)	(3.372)	(3.381)	(0.119)	(0.204)	(0.216)
Observations	174	174	174	174	174	174	174	174	174

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab, Budapest and all micro-regions neighboring Budapest. t_0 variables represent 1999 values, while Δ variables represent 1999 to 2003 changes, except for Δ import exposure, a hybrid variable constructed from 1999 level and 1999 to 2003 change variables. The import exposure variable is calculated from consumer good imports to Hungary from 11 Asian countries. In this table, it is instrumented with a similar variable calculated from 1998 level variables and imports to Spain instead of Hungary, and the controls indicated in each column. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 1999 share of national population.

Table 4.9: Exposure to consumer good imports from 11 Asian countries and employment outcomes, reduced form, 2003-2007

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-0.550*	-0.230	-0.276	-0.543	-0.297	-0.257	0.241*	0.249**	0.244*
instrument	(0.253)	(0.274)	(0.261)	(0.444)	(0.215)	(0.189)	(0.102)	(0.0967)	(0.101)
manufacturing		-0.0941***	-0.0856**		-0.0721	-0.0794		-0.00252	-0.00148
employment t_0		(0.0218)	(0.0279)		(0.0619)	(0.0675)		(0.0161)	(0.0177)
Δ manufacturing			0.00146***			-0.00126***			0.000178
FDI per worker			(0.000298)			(0.000207)			(0.000187)
Constant	-1.153	0.954	0.877	3.948	5.561	5.628	0.922*	0.978	0.969
	(0.884)	(1.449)	(1.496)	(2.216)	(3.415)	(3.458)	(0.467)	(0.607)	(0.615)
Observations	174	174	174	174	174	174	174	174	174
R-squared	0.036	0.082	0.094	0.068	0.119	0.137	0.095	0.096	0.098

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab. t_0 variables represent 2003 values, while Δ variables represent 2003 to 2007 changes, except for Δ import exposure instrument, a hybrid variable constructed from 2002 level and 2003 to 2007 change variables. The import exposure variable is calculated from consumer good imports to Spain from 11 Asian countries. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 2003 share of national population.

4.4 The effect on wages

Finally, I briefly discuss the problems with estimating the effects on wages. While I expected both manufacturing wages and wages in general to be negatively affected by greater import exposure, at least in the preferred specifications, I find generally non-significant effects on manufacturing wages, and significant positive or non-significant effects on wages in general. Table 4.10 presents the estimated coefficients from the 2003-2007 reduced form regression (with both usual controls included), both for the full sample and the sample with Budapest and the neighboring micro-regions omitted, as in Subsection 4.3.1. The estimated coefficient from the full sample means that a one standard deviation increase in this import exposure measure is associated with a .7 percent greater wage change. I got similar results in a number of estimations. The positive significant coefficients on wages remain a puzzle. One possible solution is that this is simply a bad quality wage data (as described in Section 3.3, it is created by dividing total labor cost of all [or all manufacturing] firms by total [or total manufacturing] employment per micro-region, which is then deflated, logged and differenced).

Table 4.10: Estimated coefficients of exposure to Chinese consumer good imports on two wage outcomes, reduced form, 2003-2007

Dependent variable	full sample	without Budapest & neighboring
Δ log (average manufacturing wage)	0.0663	0.0435
	(0.0550)	(0.0545)
Δ log (average wage)	0.00945**	0.00814**
	(0.00303)	(0.00288)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Column (1) corresponds to column (9) of Table 4.6, while column (2) corresponds to column (9) of Table A.3 with only the dependent variables changed to wage variables explained above.

Chapter 5

Conclusion

In this thesis, I analyzed the relationship between increasing exposure to Chinese import competition and labor market outcomes in Hungarian micro-regions, building on a method proposed by Autor, Dorn and Hanson (2013). I used data from several different sources and looked at three 4-year-long time windows between 1995 and 2007.

I presented the argument why the original import exposure measure might be endogenous, and proposed using Spanish import data to construct the instrumental variable for Hungary. I focused my attention on three outcome variables, the change of manufacturing and non-manufacturing employment rate and unemployment rate. Due to the ambiguous effect of imported production inputs and problems with the first stage estimation, in most estimations I used import exposure measures constructed from consumer good imports only. I was not able to find a statistically significant effect on these outcome variables in a number of different estimations and three kinds of robustness checks, except for a small positive association with the change in the unemployment rate between 2003 and 2007.

I do not claim that my results prove that the effects I tried to estimate are actually zero. However, I think that based on my results and the firm level analysis by Csermely, Harasztosi and Pellényi (2012) together, a quite strong case could be made that trade with China did have an effect on a few industries in Hungary, but it did not cause economy-wide structural changes as in some other countries.

I think both an employee-level analysis on the effect of import exposure and a similar regional analysis using data from several Central and Eastern European countries (or one larger country such as Poland) would be very useful in putting these results in context.

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Appendix A

Tables

Table A.1: Example on product-to-industry conversion and harmonization of imports. Top 5 (in value) 6-digit products imported to Spain and the top product assigned to more than one industries, in 1995

HS1992	Description	Relevant section of CN-Prodcom conversion table		NACE Rev. 1, 4-dig	Description	NACE Rev. 1.1, 3-dig	Description
852731	Radio-telephony receiver, with sound reproduce/record	85273110	32301175	3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods	323	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods
		85273191	32301175				
		85273199	32301175				
950210	Dolls representing only human beings	95021010	36501100	3650	Manufacture of games and toys	365	Manufacture of games and toys
		95021090	36501100				
420292	Containers nes, outer surface plastic or textile	42029211	19201250	1920	Manufacture of luggage, handbags and the like, saddlery and harness	192	Manufacture of luggage, handbags and the like, saddlery and harness
		42029218	19201250				
		42029291	19201250				
		42029298	19201250				
270400	Coke, semi-coke of coal, lignite, peat, retort carbo	no Prodcom code for raw materials			unmatched		
847192	Computer input or output units	84719210	30021400	3002	Manufacture of computers and other information processing equipment	300	Manufacture of office machinery and computers
		84719290	30021400				
…							
621133	Mens, boys garments nes, of manmade fibres, not knit	62113310	18213015	1821	Manufacture of workwear [weight=0.5]	182	Manufacture of other wearing apparel and accessories
		62113331	18242215	1824	Manufacture of other wearing apparel and accessories n.e.c. [weight=0.5]		

Table A.2: Exposure to total Chinese imports and employment outcomes, reduced form, 1999-2003

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-0.438	0.162	0.153	-0.656	0.178	0.175	-0.0790	-0.0708	-0.0693
instrument	(0.288)	(0.427)	(0.420)	(0.608)	(0.325)	(0.335)	(0.0659)	(0.0618)	(0.0598)
manufacturing		-0.0706	-0.0786		-0.0980	-0.100		-0.000959	0.000319
employment t_0		(0.0447)	(0.0461)		(0.0870)	(0.0887)		(0.00605)	(0.00668)
Δ manufacturing			0.00123			0.000369**			-0.000197
FDI per worker			(0.000819)			(0.000135)			(0.000151)
Constant	-0.674	0.825	1.018	2.794	4.874	4.932	-0.583***	-0.563**	-0.594**
	(0.588)	(1.480)	(1.499)	(2.106)	(3.645)	(3.679)	(0.157)	(0.222)	(0.235)
Observations	174	174	174	174	174	174	174	174	174
R-squared	0.004	0.022	0.030	0.015	0.070	0.072	0.004	0.004	0.011

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab. t_0 variables represent 1999 values, while Δ variables represent 1999 to 2003 changes, except for Δ import exposure instrument, a hybrid variable constructed from 1998 level and 1999 to 2003 change variables. The import exposure variable is calculated from total Chinese imports to Spain. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 1999 share of national population.

Table A.3: Exposure to total Chinese imports and employment outcomes, reduced form, 2003-2007

Dependent variable	Δ manufacturing employment			Δ non-manufacturing employment			Δ unemployment rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ import exposure	-0.787*	-0.347	-0.343	-0.0289	-0.0755	-0.0785	0.190	0.238	0.237
instrument	(0.350)	(0.364)	(0.366)	(0.124)	(0.130)	(0.135)	(0.124)	(0.127)	(0.123)
manufacturing		-0.125***	-0.123***		0.0132	0.0121		-0.0137	-0.0142
employment t_0		(0.0256)	(0.0250)		(0.0109)	(0.0107)		(0.0165)	(0.0164)
Δ manufacturing			0.00141			-0.000991			-0.000426*
FDI per worker			(0.00181)			(0.000670)			(0.000219)
Constant	-0.527	2.690*	2.629*	1.235**	0.895	0.938	1.368**	1.723**	1.741**
	(0.808)	(1.254)	(1.225)	(0.393)	(0.513)	(0.515)	(0.518)	(0.547)	(0.551)
Observations	164	164	164	164	164	164	164	164	164
R-squared	0.045	0.113	0.114	0.000	0.004	0.008	0.040	0.053	0.055

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Sample is all micro-regions of Hungary except for Tab, Budapest and all micro-regions neighboring Budapest. t_0 variables represent 2003 values, while Δ variables represent 2003 to 2007 changes, except for Δ import exposure instrument, a hybrid variable constructed from 2002 level and 2003 to 2007 change variables. The import exposure variable is calculated from Chinese consumer good imports to Spain. All robust standard errors are clustered on NUTS-2 region. All models are weighted by micro-regions' 2003 share of national population.

Table A.4: Exposure to consumer good imports from 11 Asian countries and employment outcomes, 2SLS 1st stage, 1999-2003

Dependent variable	Δ import exposure		
	(1)	(2)	(3)
Δ import exposure instrument	0.140***	0.136***	0.138***
	(-0.018)	(-0.020)	(-0.019)
Observations	174	174	174
R-squared	0.70	0.70	0.71
F-statistic	57.81	33.34	27.71

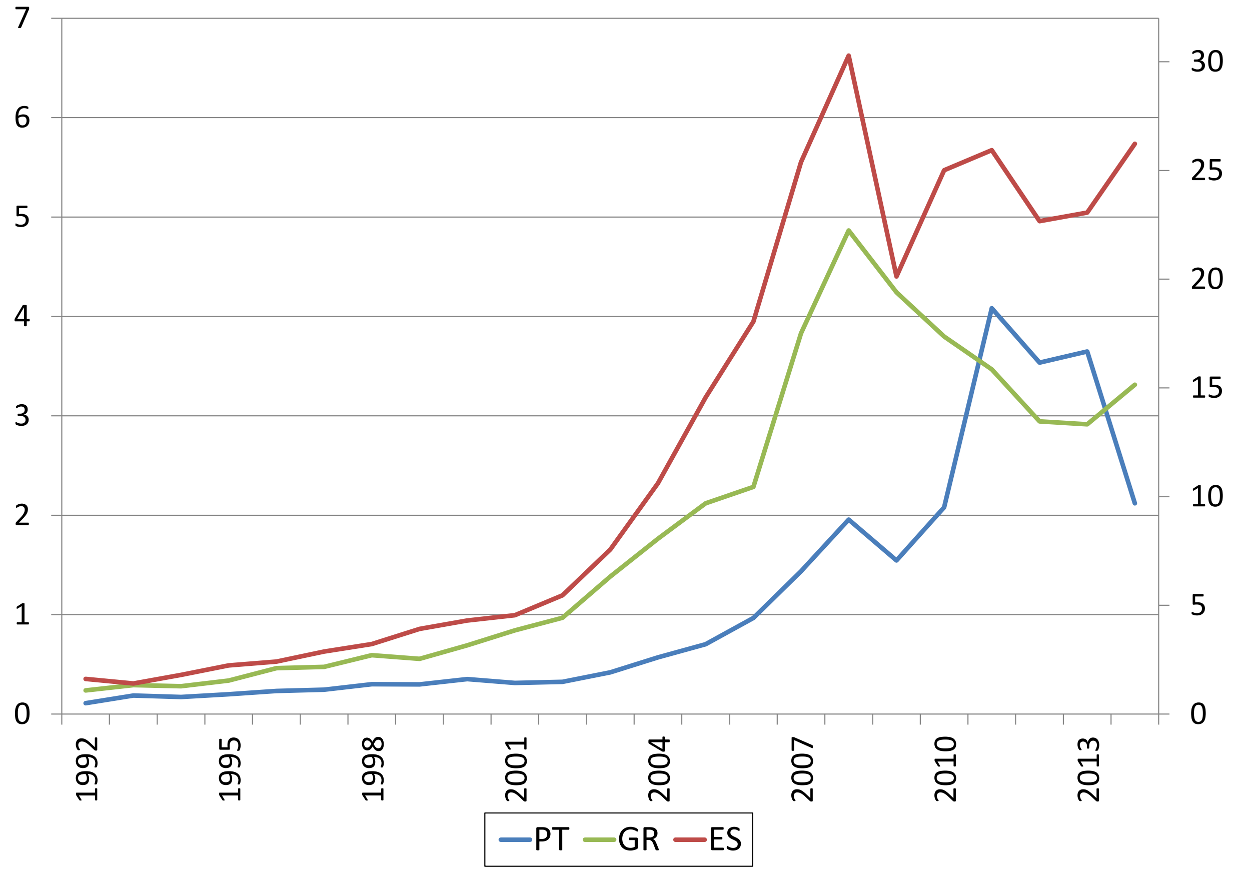
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: First stage estimates for Table 4.8, explained in the notes for that table.

Appendix B

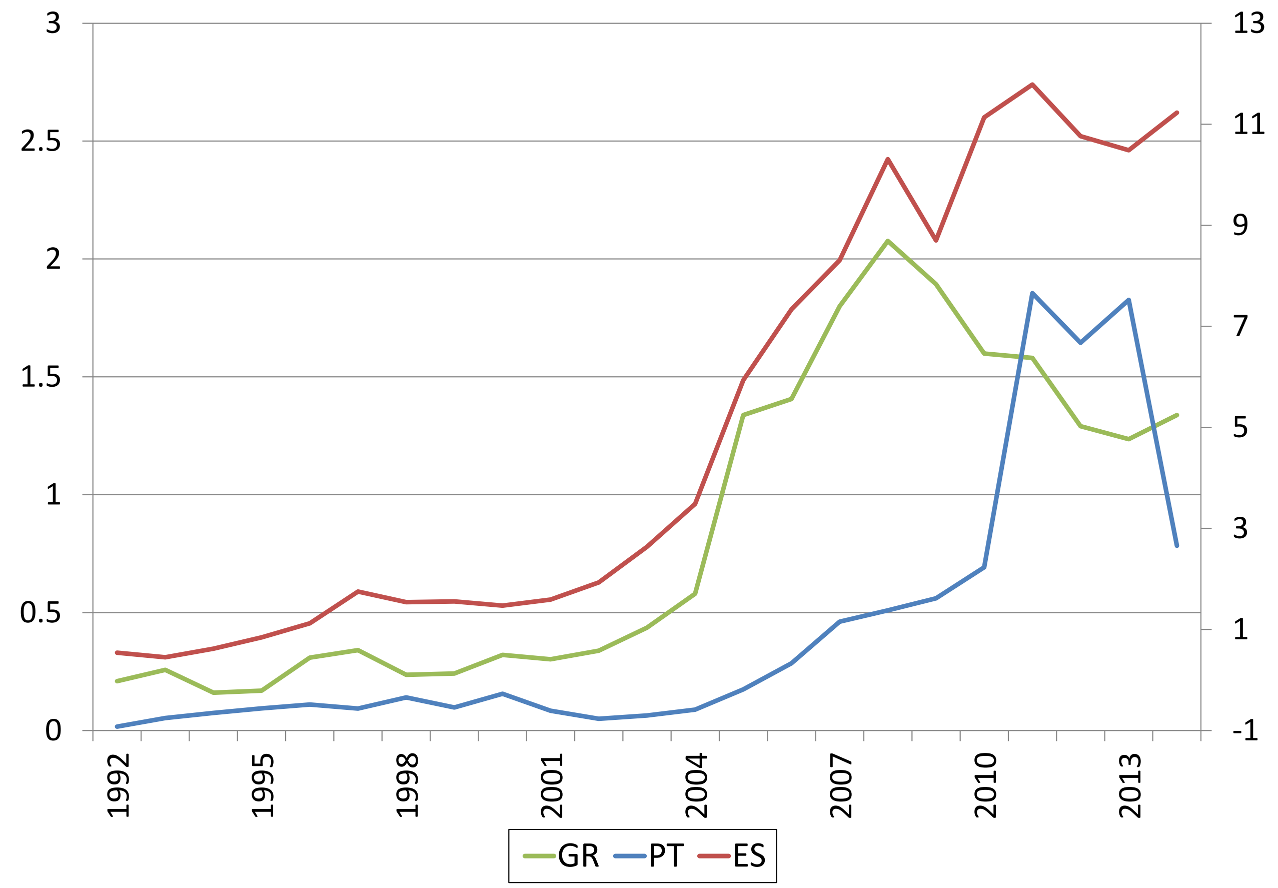
Figures

Figure B.1: Chinese imports to Portugal, Greece (left scale), and Spain (right scale), 1992 to 2014 (current billion euros). Source: UN Comtrade.



Source: UN Comtrade data

Figure B.2: Chinese imports to Portugal, Greece (left scale), and Spain (right scale) of HS2 products 64–"Footwear, gaiters and the like, parts thereof", 1992 to 2014 (current 100 million euros). Source: UN Comtrade.



Source: UN Comtrade data