Piriu, Andreea Alexandra

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Trade Shocks, Job Insecurity and Individual Health

Andreea Alexandra Piriu[1,2,3]

[1] Department of Environmental Science and Policy, University of Milan, Italy
[2] Department of Economics, Management and Quantitative Methods, University of Milan, Italy
[3] Global Labor Organization
Correspondence: Department of Environmental Science and Policy, Via Celoria 2, 20133 Milan, Italy. E-mail: Andreea.Piriu@unimi.it

Abstract. As the COVID-19 pandemic unfolds, future health care expenditure is likely the discriminant between nations who will build resilience and those who will not. Despite costly labor-market adjustments due to increased international trade over the last two decades, the health effects of trade liberalization are underexplored, with potentially wide implications for public policy and national budgets. Given the remarkable increase in trade volumes between Germany and China following reunification, this paper studies the causal effects of Chinese import competition on the health outcomes of individuals working in the German manufacturing sector. Results in this reduced-form approach exploiting region-industry variation in imports over 22 years show that higher import competition from China increases the individual demand for healthcare and probability of developing chronic illness via job insecurity, job loss and occupational change, an increased reliance on social welfare, and wage reduction. I find that individuals increase their visits to the doctor by 14 per cent and are 18.4 to 20.6 per cent more likely to develop chronic illness, on average. Results are robust for alternative health outcomes and across different population subgroups. The paper calls for reshaping health policy such that it governs well-being, starting with prevention and adequate care for working individuals: amidst globalization and recent chronic disease management, it is fundamental that future sustainable health policy champions the idea that creating better jobs means avoiding preventable costs of care from increased healthcare utilization and hence more effective chronic care through the introduction of preventive primary care plans for vulnerable working population segments.

JEL classification: F14, F16, I12, I15.

Keywords: trade, labor, job insecurity, individual health, chronic illness, healthcare utilization.

1. Introduction

Recent studies have shown that higher import competition from China worsened labour market conditions and led to manufacturing decline in advanced economies (Autor, Dorn and Hanson, 2013; Dauth, Findeisen and Suedekum, 2014; Acemoglu et al., 2016; Pierce and Schott, 2016; Dauth, Findeisen and Suedekum, 2017; Dauth et al., 2021). However, the extent to which trade shocks affect individuals' health and the mechanisms thereby involved remain underexplored. This could lead to inappropriate resource allocation for effective care and disease management, which in turn could have deeper and long-lasting implications for health care utilization and the costs of health care.

This paper investigates the causal link between trade liberalization and individual health, and how job insecurity and labor market conditions feed into that link. More specifically, the analysis examines how trade shocks affect health care utilization and chronic illness at an individual level, where trade shocks indirectly affect individual health via job insecurity and negative labor market outcomes. I look at trade shocks related to Chinese imported goods, i.e., imports that are directly traceable to manufactured goods from China. To investigate the causal effect of import shocks on individual health, I construct an instrumental variable that isolates the exogenous supply-driven variation in imports from China – an argument that is contextual to China's accession to the World Trade Organization in late 2001 and, thus, to the liberalization of trade.

Germany has been through a remarkable transformation since the mid-1990s due to lower trade barriers, reduced labor unit costs and an increased use of imported intermediate inputs in the manufacturing sector (Dustmann et al., 2014). Following reunification, Germany's export orientation coupled with long spells of unemployment and a series of structural reforms made the country subject to significant compositional shifts in the labor force. During this time, trade

liberalization has not only led to gains from trade in export-competing sectors but has also caused job losses in import-competing manufacturing industries, of at least equal proportion (Dauth, Findeisen and Suedekum, 2014; Dauth, Findeisen and Suedekum, 2017).

Although evidence in industrialized countries shows a dramatic development in wage inequality and structural change in the context of increased trade and offshoring (Goldin and Katz, 2007; Dustmann, Ludsteck and Schönberg, 2009; Antonczyk, Fitzenberger, and Sommerfeld, 2010; Card, Heining, and Kline, 2013; Autor, Dorn and Hanson, 2013; Dustmann et al., 2014; Ebenstein et al., 2014; Artuç and McLaren, 2015), potential effects on individual health are still largely unknown. Stylized facts and related literature indicate that chronic pain and health care costs have exploded worldwide – especially in the US, where health care expenditure is the world's highest (OECD Statistics, 2020), followed by Switzerland and Germany – simultaneously with an escalating opioid epidemic (Manchikanti et al., 2012; Nelson et al., 2015; Murthy, 2016) that may be linked with US manufacturing employment decline (Currie et al., 2019; Venkataramani et al., 2020).

The effects of trade-induced labor market shocks can differ substantially across individuals depending on their sector of work and skill level (Helpman et al., 2017; Adao et al., 2019; Kim and Vogel, 2021). This is in line with early theoretical predictions and related evidence pointing to differences in socio-economic status and sector-specific human capital formation (Beck et al., 1978; Rodrik, 1995; Elliott and Lindley, 2006; Croll, 2008; Smith, 2010). Because of the distributional effects of trade liberalization (Krugman, 2008; Autor, Dorn and Hanson, 2013; Helpman et al., 2017), it is reasonable to expect that these trade-induced variations in labor market conditions may also affect the individual's health, and even more so workers in tradeable sectors such as manufacturing.

Furthermore, German productivity and economic performance rely heavily on manufacturing workers, who represent roughly a fifth of German employment (Destatis, 2019), making Germany one of the world's economic locomotives. Since the share of manufacturing workers in industrialized countries is typically non-negligible, it is fundamental to understand the socio-economic determinants of individual health contextually with trade liberalization, therefore starting with Germany, Europe's largest exporter.

Based on German micro-level data, Geishecker et al. (2012) show that import competition plays a major role in how an individual perceives job insecurity in Germany, where higher job loss fears and economic uncertainty are outcomes of globalization, cheaper imports, and offshoring. Job insecurity, on the other hand, can have detrimental effects on health and chronic illness in Germany and other Western countries (Laszlo et al., 2010).

Using longitudinal data on individuals from the German Socio-Economic Panel, this paper combines multiple other sources to derive a unique sample of workers that were employed in an import-competing industry of German manufacturing for at least one year between 1995 and 2016, and who were subject to differing degrees of import competition from China, depending on the industry and federal state of employment (22 manufacturing industries and 16 federal states).

Findings in this reduced-form analysis suggest that higher import competition negatively affects the health status of individuals in German manufacturing. Baseline results show that workers have an 18.4 per cent greater probability of developing chronic illness and increase their visits to the doctors by 14.3 per cent, on average. Mechanisms that potentially explain the decline in individual health are greater job insecurity and negative labor market outcomes, i.e., higher probability of job loss and occupational change, reduced earnings, and increased

reliance on social benefits. When factoring in these labor market variables and job insecurity, I find that the probability of developing chronic illness further increases to 20.6 per cent.

To create better jobs, inform health planning, and avoid further public health emergencies and burdened national budgets, results should be interpreted in the context of past years' health policy in Germany. Despite generous state health care coverage and high availability of services, Germany ranks among the top three OECD countries with the highest rate of hospitalizations for chronic conditions such as diabetes and congestive heart failure (OECD, 2019), running a health expenditure of EUR 410.8 billion in 2019, or 11.9% of GDP (Destatis, 2021). Although the country undertook major health care reforms to reduce the variation of care over the last two decades (Busse and Riesberg, 2004), chronic care still faces barriers related to the financing mechanism, alongside other concerns towards eligibility and service provision (Fullerton et al., 2011; Fullerton et al., 2012; Knai et al., 2013; Nolte et al., 2014).

Moreover, motivated by concerns about future health policy, estimates in this paper allow also to attempt a back-of-the-envelope calculation – if Chinese import competition increases the probability of developing chronic illness by roughly 19.5 per cent (average of 18.4 and 20.6 per cent) and there are 7.4 million manufacturing workers in Germany, then associated costs of healthcare at a mean of EUR 4,944 per inhabitant will be roughly 7.1 billion, or in the range of EUR 6.7 billion to 7.5 billion. That is, a yearly increase of 1.7 per cent compared to the 2019 health spending, without considering a higher average cost of care per inhabitant for chronic patients. The figure coincides with a similar calculation by Colantone et al. (2019) for the UK. As a result, numbers suggest that health care costs for manufacturing workers with a higher probability of chronic illness would put additional pressure on German public expenditure.

Finally, the paper contributes to the joint efforts of reducing the variation of care and health inequalities by shedding light on the challenges faced by working individuals in a globalized

world. The results also ring an alarm bell on the importance of designing sustainable health plans to avoid preventable costs of care from increased chronic care utilization. Results call for policy actions that jointly provide workers effective chronic care and introduce preventive primary care plans in import-competing manufacturing industries, where risk of chronic illness is roughly 20% higher due to import shocks.

The paper is organized as follows: Section 2 reviews evidence on the trade-induced labor market and health effects. Section 3 describes the empirical framework, data and the empirical specification. Section 4 discusses the baseline results backed up by robustness and heterogeneity checks, then investigates potential mechanisms of how import competition affects individual health. Section 5 discusses the results, while Section 6 concludes and advocates for more effective health policies to respond to the needs of working individuals in a globalized world, and ultimately redefine well-being by promoting preventive primary care as sustainable health plans in import-competing manufacturing industries.

2. Related Literature

This section reviews recent health policy and institutional setting in Germany first, and then focuses on trade liberalization and its effects on labor markets and health.

Regulation of health care in Germany is shared between the federal government and 16 state governments, and all residents must take out health insurance. The German health system is financed mainly from Social Health Insurance (SHI) funds (70.9 per cent), complemented by out-of-pocket payments (12.5 per cent), compulsory private insurance schemes (7.2 per cent) and voluntary health insurance (2.9 per cent) (WHO, 2021).

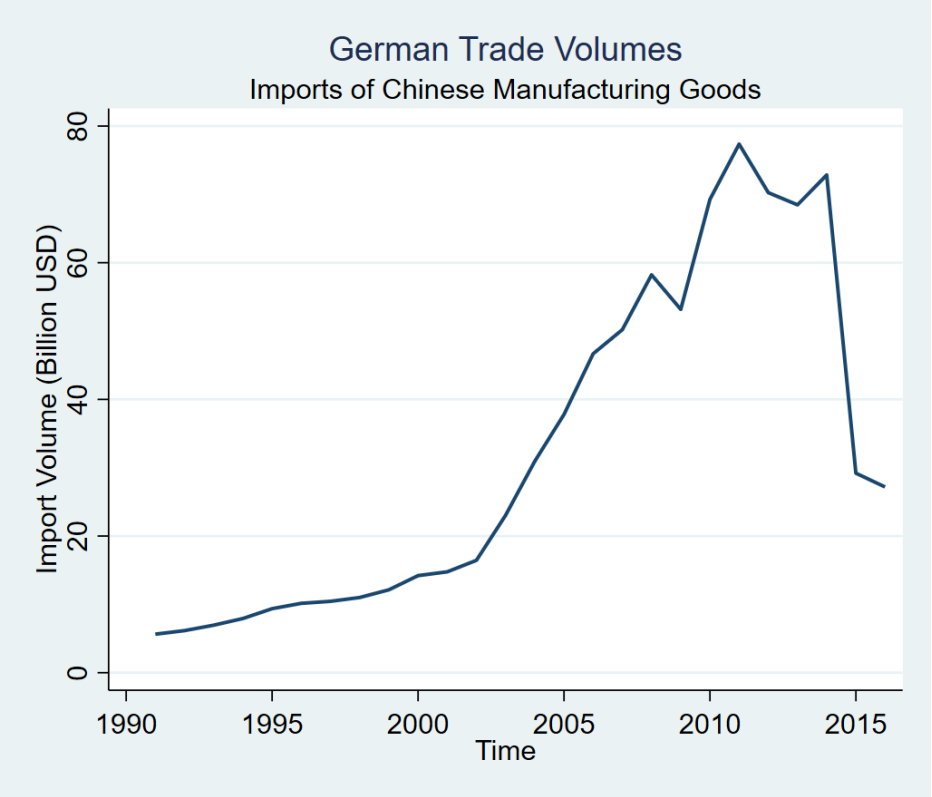
Across the OECD, Germany is among the top three countries for health expenditure, both as a proportion of GDP and per person (OECD Statistics, 2020). Total national health expenditure amounts to EUR 410.8 billion in 2019, or 11.9 per cent of GDP, equivalent to EUR 4,944 per inhabitant (Destatis, 2021). Access to health care services in Germany is ensured by a wide health infrastructure with high availability of health professionals and generous health care coverage – ranking third among OECD countries for the share of costs covered by the government and compulsory insurance schemes (OECD, 2019).

However, Germany also ranks among the top three OECD countries with the highest rate of hospitalizations for chronic conditions such as diabetes and congestive heart failure (OECD, 2019). This calls for a closer look at recent health policy. Since the early 2000s, reforms to reduce variation of care have entailed both structural and financial decisions[1] such as fragmentation between ambulatory and hospital care, disease management programmes (DMPs) and integrated care for multi-morbidity across Germany, and morbidity-adjusted risk compensation schemes (Busse and Riesberg, 2004; Nolte et al., 2014).

Despite this steady and consistent approach to developing and adjusting chronic disease management policy, German chronic care still faces concerns towards financing, eligibility and service provision (Fullerton et al., 2011; Fullerton et al., 2012; Knai et al., 2013; Nolte et al., 2014), where effectiveness of DMPs is still largely disputed (Bourbeau et al., 2019; Laxy et al., 2015; Fuchs, et al., 2014; Roccaforte et al., 2005).

Furthermore, besides recent health policy, the period observed in this study is a time of great structural change in Germany. After the East-West German reunification, the country is left with a high fiscal burden and high unemployment, and subsequently lowers trade barriers using manufactured inputs from abroad to gear up the German manufacturing sector, thus becoming more internationally competitive. Figure 1 illustrates how imports from China increased steadily from mid-1990s to early 2000s, and dramatically thereafter, simultaneously with China's accession to the WTO in 2001.

FIGURE 1 Imports of Chinese Manufacturing Goods in Germany



Source: Author's computations based on import data from UN Comtrade

Trade-wise, this paper corroborates evidence on the effects of import competition on local labor markets with evidence on the health effects of such trade-induced shocks.

Most notably, evidence on trade-induced shocks to labor market conditions shows how import competition from China causes unemployment, lower labor force participation and wage decline in U.S. local labor markets (Autor, Dorn and Hanson, 2013; Acemoglu et al., 2016), with similar results for Germany when it comes to import-competing sectors (Dauth et al., 2014; Dauth et al., 2017). Besides a widely documented widening of the wage structure (Krugman, 2008; Autor, Dorn and Hanson, 2013), trade liberalization also comes with costly labour-market adjustments (Helpman et al., 2010; Artuç et al., 2010; Dix-Carneiro, 2014; Caliendo et al., 2019). Effects can vary on a country or skill basis (Helpman, 2017; Adao et al., 2020; Kim and Vogel, 2021), with trade shocks reducing skill premium in non-developing countries (Cigno et al., 2018) and fewer employment opportunities for men in advanced economies (Autor, Dorn and Hanson, 2019).

In terms of health, an important stream of literature documents positive effects of trade liberalization on children's health in low- and middle-income countries, access to health care, medicine and nutritious food (Levine and Rothman, 2006; Bettcher et al., 2000; Olper et al., 2018), usually possible through several pathways such as economic growth, reforms and public policies that deal with employment, wages, medical treatment and public health programmes (Pritchett and Summers, 1996; Subramanian et al., 2002, McNeill et al., 2017; Caldwell, 2001). Additionally, trade liberalization via export expansion also has a positive effect on workers' health outcomes (Feng et al., 2021). Notwithstanding, evidence so far shows that the positive effects of trade liberalization are heterogeneous across countries and individuals, as health outcomes are most likely determined by factors such as trade rules (Barlow and Stuckler,

2021), inclusive and pro-growth attitudes (Barlow, 2018), or political regime, income level and taxation (Olper et al., 2018).

Consequently, as noted in Blouin et al. (2009), it is not sufficient to boost economic growth through trade policy. Recent studies argue that trade liberalization is a vector for the surge in bad eating habits leading to obesity (Lopez et al., 2017; Barlow et al., 2018; Giuntella et al., 2020), harmful health behaviors (Friel et al., 2013; Schram et al., 2017), and food insecurity among the poorest households in low-income countries (Barlow et al., 2020).

Moreover, when considering high-income countries, effects of trade liberalization on health are prevalently negative. Effects include greater injury risk at firms facing greater shutdown risk due to import competition (McManus and Schaur, 2016), a rise in morbidities and worsened physical health (Lang et al., 2018), increased mental distress (Colantone et al., 2019), worsened health behavior related to decreased health care utilization and increased hospitalization (Adda and Fawaz, 2020), and even drug overdose mortality and uptake of disability benefits due to import penetration (Pierce and Schott, 2020).

As for job insecurity, studies show that trade liberalization can indeed lead to greater job insecurity and worsened working conditions (Blouin et al., 2009; De Vogli, 2011; Geishecker et al., 2012). In turn, job insecurity plays a central role in determining health, leading to poor health and greater chronic illness in Germany and other Western countries (László et al., 2010), but also to headaches, skin problems and fatigue (Caroli and Godard, 2016).

In a globalizing world, there may be individuals that lose out in terms of health and well-being, and their current health status may be an outcome of the structural change brought about by globalization. Worsened health and job insecurity may be among the hidden effects of globalization but, since job insecurity is also a social determinant of health, it makes sense to investigate the causal link between trade liberalization (as a driver of structural change) and

individual health, and how job insecurity and labor market conditions feed into that link. In doing so, this paper's focus will be on chronic illness and health care utilization in Germany, and what potential effects of trade liberalization might imply for future health policy and the national budget.

3. Methodology

This section details the empirical framework, data and the baseline equation. The paper follows an Instrumental Variable (IV) strategy proposed in Autor, Dorn and Hanson (2013) and isolates the supply-driven component of imports from China.

In contrast to Autor, Dorn and Hanson (2013), this paper breaks down the regional variation in import penetration into variation by industry of employment. The industry dimension of a region's yearly exposure to Chinese and EE imports matters, in that individuals may choose their industry of work depending on the degree of well-being they expect to derive. Moreover, some industries outperform others in certain areas (e.g. the Bayern area for automotive production), hence it makes relatively more sense to consider a variation that is more in tune with yearly regional economic performance, where an industry shock is weighed by a regional weight. In addition, an industry-state variation year-on-year is appropriate also considering the differentials between federal states in post-reunification Germany, where the dynamics of the East were different from those of the West.

3.1 Empirical Framework

This section now computes import exposure measures from data on the sixteen German federal states and twenty-two manufacturing industries classified at 2-digit level as per the Statistical Classification of Economic Activities in the European Community Revision 1 (hereafter, NACE Rev. 1) over twenty-two years from 1995 to 2016. Reformulated from Autor et al. (2013), the main measure for exposure to Chinese imports is computed according to industry *k*, federal state of employment *j* and time *t* as follows:

$$IE_{jkt} = \frac{E_{jkt}}{E_{jt}} * \frac{M_{kt}}{E_{kt}} \qquad (1)$$

E_{jkt} is the number of employees working in region *j* and industry *k* at time *t*, while E_{jt} is the yearly number of employees working in region *j*. M_{kt} is the yearly import value for an industry *k* as mapped from Standard International Trade Classification Revision 3 (hereafter, SITC Rev. 3) to NACE Rev. 1. Finally, E_{kt} is an industry's employment level at time *t*. For all levels employed in the analysis, *t* runs from 1995 to 2016. The resulting measure is the yearly EUR value for Chinese import competition for employees working in region *j* and industry *k* at time *t*. The first ratio gives the share of an industry *k*'s employment in regional employment at time *t*, while the second ratio can be seen as an import "shock" per employee in industry *k* at time *t*.

The main concern with Chinese import competition computed as in equation (1) is its potential endogeneity. That is, unobserved demand shocks may rise imports from China simultaneously with increasing individual health. As a result, Ordinary Least Squares (OLS) estimates would be biased.

I instrument equation (1) using Chinese imports into three high-income countries – Australia, Canada and Japan. The IV identifies the presumably exogenous component of import competition from China and rules out the variation due to shocks to the German product demand. The supply shock argument is backed up by China's accession to the WTO in late 2001. As in Dauth, Findeisen and Suedekum (2014), I exclude direct neighbours and members of the Economic and Monetary Union (EMU) because of a high degree of similarity and integration between EMU countries, which would prevent identification and violate the exclusion restriction. However, unlike Autor, Dorn and Hanson (2013) and Dauth, Findeisen and Suedekum (2014), no European countries were included in the instrument group of countries, irrespective of their (non-) membership status in the EMU, as there is observed continuous trade flows between Germany and countries such as the UK, Norway, Sweden and Finland in the sample period 1995-2016. These countries might affect German regional

performance given Germany's connection to the North and Baltic Seas. I instrument for import competition from China as follows:

$$INST_{jkt} = \frac{E_{j,k,t-1}}{E_{j,t-1}} * \frac{M_{kt}^{AUS/CAN/JPN}}{E_{k,t-1}} \quad (2)$$

Equation (2) uses five-year lagged employment values for Australia, and ten-year lags for Canada and Japan, denoted here as *t-1* for ease of read. Lagging employment levels helps mitigate against any shocks which simultaneously impact on the country's imports and regional performance variables. Summing up, the instrument in equation (2) identifies the exogenous component of Chinese imports and wipes out effects of possible simultaneous shocks.

3.2 Data

Longitudinal data on individuals come from the German Socio-Economic Panel (GSOEP). The population-based survey starts in 1984, initially comprising data primarily from the Federal Republic of Germany and subsequently adapted to include individuals from the German Democratic Republic (Wagner, Frick, and Schupp 2007; Goebel et al. 2019). Variables in GSOEP are individual characteristics such as age, gender, marital status, employment status and industry of employment. The latter comes coded as two-digit NACE Rev. 1 classes of economic activity.

Data on imports were retrieved from the UN Comtrade Database and the OECD Structural Analysis Database (OECD, 2018) as SITC Rev. 3 or International Standard Industrial Classification (ISIC) Rev. 3 product codes. These import product categories were then mapped to NACE Rev. 1 to match individuals with import exposure measures according to their industry and state of employment[2]. Also, import volumes were converted from USD to EUR according to the Deutsche Bundesbank (2019) average of daily exchange rates in 2006 for both Chinese import exposure and its instrument.

Annual state-level employment numbers (E_{jt}) and industry-level employment (E_{kt}), as well as annual statistics of employees working in state j and industry k (E_{jkt}) are sourced from Eurostat and the Federal Statistical Office of Germany (Destatis). The time window is 1995 to 2016. Specifically, the industry-related figures E_{kt} and E_{jkt} were retrieved from the European Commission's Structural Business Statistics database, coded in the form of NACE Rev. 1 till 2007 and NACE Rev. 2 after 2008, and were converted to NACE Rev. 1 as per Eurostat (2018a) ensuring consistency in converting. As for the instrument, lagged employment levels in equation (2) were sourced from the OECD Structural Analysis Database, while AUS/CAN/JPN import data come from the UN Comtrade Database. Mapping from SITC Rev. 3 and ISIC Rev. 3 to NACE Rev. 1 was performed (with reference to Eurostat, 2018a; Eurostat, 2018b; Eurostat, 2018c; Eurostat, 2018d).

3.3 Final Sample and Variables

3.3.1 Final sample

The final sample contains 57,702 observations corresponding to 11,383 individuals who are observed for 9.34 years, on average. The sample consists of all individuals who were employed in a manufacturing industry (22 NACE manufacturing industries) at least once during the panel period 1995 to 2016. These are individuals who (1) have stayed in the same manufacturing industry during the panel period, (2) have transitioned to a different manufacturing industry, or (3) have entered either the service/agricultural sector or non-employment[3]. The workers in the pre-sample (i.e. who have been employed in manufacturing at least once) are then matched with a measure of import exposure based on their industry and state of employment. Intersectoral mobility shows that most manufacturing workers in the panel period stay in manufacturing (Tables A.1 and A.2 in the Appendix).

Moreover, the industry of employment for those that in a given year no longer work in a manufacturing industry (i.e. went out of manufacturing) was rewound to their prior manufacturing industry. Thus, workers who went out of manufacturing were given import exposure values corresponding to their manufacturing industry and federal state of employment from the year leading to the change. The monetary values of import exposure were left to vary year on year provided the allocation above. On the other hand, workers who stay in manufacturing but change industries within manufacturing are given exposure values corresponding to their current industry and state of employment, and these vary year on year.

3.3.2 Descriptive statistics and variables

Table 1 presents descriptive statistics on the individual-level variables. Roughly 70% of the sample are males, the average age of individuals is 42 years and 65% are married. The average number of years spent in education is around 12 years, and 75% are employed full time while 22% are part-time and 3% are not employed. The average personal income is EUR 33,217 and people work for 1971 hours annually.

TABLE 1 Descriptive Statistics on Individual-Level Variables

Variable	Mean	Std. Dev.	Obs.
Number of Annual Doctor Visits	7.481	12.626	57702
Frequent Exercise (Bimodal Scoring)	0.439	0.496	33756
Chronic Illness Status	0.282	0.450	17840
Disability Status of Individual	0.053	0.225	57671
Physical Pain Last 4 Weeks	0.288	0.453	21287
Age of Individual	41.6	10.928	57702
Male	0.698	0.459	57702
Number of Years of Education	11.862	2.453	57702
German National	0.871	0.335	57702
Number of People in HH	3.085	1.313	57702
Number of Children in HH	0.821	1.045	57702
College Degree	0.152	0.359	57702
High School Degree	0.687	0.464	57702
Less Than High School Degree	0.161	0.368	57702
Married	0.653	0.476	57702
Single	0.245	0.430	57702
Divorced	0.072	0.258	57702
Separated	0.019	0.138	57702
Widowed	0.010	0.101	57702
East Germany	0.171	0.377	57702
Employed Full Time	0.751	0.433	57702
Employed Part Time	0.218	0.413	57702
Not Employed	0.032	0.175	57702
Years at Current Employer	11.173	9.971	57664
Annual Work Hours of Individual	1971.024	686.939	57702
Individual Labor Earnings	33217.43	23618.95	57702
Individual Hourly Wage	16.49	10.74	55903
Income from Secondary Employment	226.92	1517.60	57702
Income from Self-Employment	60.15	1735.99	57702
Unemployment Benefit	93.29	755.63	57702
Maternity Benefit	28.62	449.66	57702
Child Allowance	1913.90	2219.99	57702
Housing Benefit	37.28	296.39	57702
HH Labor Income	53856.84	33898.75	57702
HH Imputed Rent	1608.29	2805.92	57702
Total HH Taxes	19118.90	15393.74	57702
HH Public Transfers	3137.59	3892.31	57702
HH Private Transfers	164.19	1146.36	57702
HH Social Security Pensions	1019.19	3928.81	57702

Tables 2 reports statistics on import exposure. The mean exposure to Chinese imports for a worker is EUR 48. Depending on the *k*-industry of employment, the extent to which a worker in region *j* at time *t* in is affected by Chinese imports goes from EUR 0.2 to EUR 841. The industries that are the most exposed to Chinese imports are high-tech and medium-high tech industries, as per the EC framework for technological intensity by occupation (Eurostat, 2018d). Any EUR 100 increase in Chinese competition corresponds to an increase of 1.55 standard deviations of the mean.

TABLE 2 Descriptive Statistics on Chinese Import Exposure (EUR)

Variable	Mean	Std. Dev.	Min.	Max.
Exposure to Chinese Imports	48	64	0	841

Industries with the lowest import exposure per worker (j,k,t)	**Value (EUR)**
16 Manuf. of Tobacco	0.2
22 Publishing, Printing and Reproduction of Recorded Media	9.28
21 Manuf. of Pulp, Paper and Paper Products	9.77
23 Manuf. of Coke, Refined Petroleum Prod, Nuclear Fuel	16.46
20 Manuf. of Wood Products (Exc. Furniture)	25.70
j=region, k=industry, t=time	
Industries with the highest import exposure per worker (j,k,t)	**Value (EUR)**
18 Manuf. of Wearing Apparel; Dressing And Dyeing Of Fur	276.47
31 Manuf. Electrical Machinery And Apparatus NEC	292.84
29 Manuf. of Machinery And Equipment n.e.c.	330.79
32 Manuf. of Radio, Television And Communication Equipment	661.50
35 Manuf. Other Transport Equipment	841.48
j=region, k=industry, t=time	Obs. 57,702

The main dependent variable, individual health, is given by the annual number of visits to the doctor (Table 1). The number of observations that report zero visits to the doctor is 21,730, or 37.7% of the total (annualized in the GSOEP based on the number of visits in the last 3 months). The choice of the dependent variable lies with the idea that more visits to the doctor may signal a worsened health status. In specialist literature, common practice uses the number of visits to the doctor as a measure of health care utilization and performance of health care systems (Bago d'Uva and Jones, 2009; Winkelmann, 2004) but also to signal patient anxiety, worsened health and potential costs of unemployment (Spoelman et al., 2016; Schmitz, 2011).

Alternative proxies for individual health are chronic illness, sport frequency, disability status, and physical pain. Except for chronic illness and disability, which are officially assessed and reported as binary variables in the GSOEP, sport frequency and physical pain have been adapted here as binary outcome variables based on a bimodal scoring method that assigns zero to the two answers corresponding to the lowest level indicated, and 1 to the two highest answers. Table A.3 in the Appendix reports all health-related questions that were sourced from the GSOEP Individual Questionnaire.

3.4 Empirical Specification

The baseline specification estimates the causal effect of import competition on individual health as follows:

$$health_{ijkt} = \alpha_i + \alpha_j + \delta_{kt} + \beta_1 * IE_{jkt} + I_{it} * \gamma + H_{it} * \tau + \varepsilon_{ijkt} \qquad (3)$$

where the dependent variable is the annual number of doctor visits for an individual *i* working in region *j* and industry *k* at time *t*. The Chinese import competition measure is computed as in eq. (1) and instrumented as in eq. (2).

To absorb unobserved shocks, individual fixed effects (α_i), state or region fixed effects (α_j) and industry-year fixed effects (δ_{kt}) are included. I_{it} and H_{it} are vectors of control variables for time-varying, observable individual and household characteristics, and an error term (ε_{ijkt}) is included. The model is mainly identified by within-individual changes in import penetration.

In the identification of the effect, potential endogeneity is addressed by the instrumental variable. The instrument is valid if (1) it affects individual health only through import exposure, (2) demand shocks in the destination country are uncorrelated with shocks in the origin country that generates exogenous variation in the trade volume, and (3) conditional on the control vectors, there is no unobserved factor correlated with the instrument.

Consequently, to protect from various sources of potential estimation biases (i.e. differences in individual health not related to Chinese import exposure), the baseline specification controls for unobserved shocks as follows. First, individual fixed effects absorb time-invariant differences in health between individuals, thus focusing on within-individual changes in health due to import competition. Second, the state and industry-year fixed effects also absorb time-invariant unobservable shocks that are assumed to affect individual health. The industry-year fixed effects typically correct for additional biases due to endogeneity by reducing variability potentially due to differences in individual health not related to the variables in the regression, but also for bias due to changes related to industry-specific technical shocks by year. State fixed effects wipe out the variation in health due to unobserved shocks to regional performance. Finally, the model allows for standard errors to be correlated between workers within the same industry and federal state of employment.

4. Results

This section quantifies the effects of import competition from China on individual health. Results hereby cannot be extended to effects of import competition on other sectors outside manufacturing. For instance, there may be effects on the service sector as well as direct effects of import competition on health but none of these are analyzed here. The paper studies only indirect effects on individual health via job insecurity and other labor market mechanisms.

4.1 Baseline results

Table 3 reports the estimates of the baseline equation (3). Columns (1) and (2) report the OLS coefficient estimates on Chinese import exposure, with col. (1) including individual and household characteristics, individual fixed effects (FEs) and states FEs while col. (2) adds industry-time dummies to the OLS estimation. Columns (3) to (5) give the fixed-effects

instrumental variable (FEIV) estimates of annual doctor visits, instrumenting as in equation (2).

TABLE 3 Baseline Estimates – Visits to the Doctor and Chinese Imports

	(1)	(2)	(3)	(4)	(5)
Chinese import exposure	0.411***	0.641**	0.436**	0.435**	1.071***
	[0.139]	[0.289]	[0.200]	[0.200]	[0.373]
Estimator	OLS	OLS	FEIV	FEIV	FEIV
Individual controls	yes	yes	yes	yes	yes
Household controls	yes	yes	yes	yes	yes
Individual fixed effects	yes	yes	yes	yes	yes
State fixed effects	yes	yes	no	yes	yes
Industry-year effects	no	yes	no	no	yes
Observations	57702	57702	55046	55046	55039
First-stage results			0.053***	0.053***	0.060***
			[0.0007]	[0.0007]	[0.0007]
Kleibergen-Paap F-statistic			5646.4	5625.3	6402.8

*p<0.10, ** p<0.05, *** p<0.01, mean doctor visits = 7.48

The dependent variable is the annual number of visits to the doctor. IE China is the yearly monetary exposure (measured in hundreds of euros) to Chinese imports for an employee working in region *j* industry *k* at time *t*. Individual controls include years of education, marital status, labour income. Household controls include household size, number of children, household labour income and welfare.
OLS estimates in col. (1) include the full set of controls as in col. (5), except for time effects. Estimation in col. (2) adds industry-time dummies to the OLS regression, while estimates in cols. (3) to (5) are FEIV. Standard errors are clustered to allow for correlation between workers within the same industry and state (reported in brackets).

The OLS estimates in columns (1) and (2) give an increase of 0.41, respectively 0.64 in the annual number of visits to the doctor upon a EUR 100 increase in competition from Chinese imports, where a hundred euro increase in Chinese import exposure is within 1.55 standard deviations of the mean. This is equivalent to a 5.5%, respectively 8.6% increase on the mean number of annual doctor visits, where the average annual number of visits to the doctor is 7.48 (Table 1, first row).

With individual characteristics, household characteristics, and individual fixed effects (col. 3), annual doctor visits increase by 0.44 from a EUR 100 increase in Chinese competition, or 5.8% on average. On adding region fixed effects, the effect stays similar (col. 4). The final specification of the baseline model (column 5) further adds industry-year fixed effects to wipe out variation from any unobserved industry-year shocks, focusing thus on industry-time variation within individual and within state, while leveraging changes in individual health due to yearly variation in industry-state cells. The coefficient is positive and significant at a 1% level, giving a 1.07 increase in annual visits to the doctor, equivalent to a 14.3 per cent increase on average annual doctor visits. The strength of the effect is surprising, and this would constitute a significant new finding.

In addition, Table (3) also reports first stage statistics and robust standard errors. The Kleibergen-Paap F-statistic is high in all specifications, indicating a strong instrument. The model allows for standard errors to be correlated between workers within the same industry and federal state in all specifications.

4.2 Robustness checks

This subsection undergoes several robustness checks following baseline results in Table 3. It first runs the analysis with alternative health outcomes as dependent variables, then it repeats the baseline estimation using a base-year weight, and finally addresses issues relating to sorting.

Chronic illness, sport frequency, physical pain and disability

Table 4 panel (a) runs the analysis with several alternative health outcomes as dependent variables. Proxies for general health and well-being include chronic illness, disability, sport frequency, and physical pain. The first two are typically officially assessed, while sport frequency and physical pain are self-reported by individuals in the panel. Estimations for

chronic illness and sport frequency run the full empirical specification in eq. (3), i.e. same individual and household characteristics, individual FEs, state FEs and industry-year FEs as per Table 3 column 5. Instead, physical pain and disability exploit a slightly different source of variation, with the same individual and household characteristics[4].

TABLE 4 Robustness Checks

	Coeff.	Robust Std. Error	Obs.	KP F-stat
(a) Alternative health outcomes: China				
Chronic illness (spec. column 5)	0.052*	0.029	15242	1724.5
Sport frequency (spec. column 5)	-0.051**	0.022	30471	3494.2
Disability (indiv, year, state FEs)	-0.006**	0.003	54019	4432.1
Physical pain (indiv, industry-yr, state-yr FEs)	0.050*	0.028	17235	1825.7
(b) Estimation with base-year weight				
Chinese import exposure	0.920**	0.415	53426	7219.2
(c) Individual-industry fixed effects				
Chinese import exposure	0.832	0.633	53608	4546.6
(d) Run analysis with Eastern European import competition				
Baseline (doctor visits)	0.686***	0.261	55039	2330.1
Alternative: chronic illness	0.024	0.022	15242	565.1
Alternative: sport frequency	-0.036**	0.016	30471	1003.4
Alternative: disability	-0.007**	0.003	54018	1096.1
Alternative: physical pain	0.041*	0.023	17235	655.3

* p<0.10, ** p<0.05, *** p<0.01
Mean probability of chronic illness = 0.282

Panels (a) runs the analysis with alternative individual health measures. Results are consistent: higher import competition translates into greater chronic illness and less frequent sport using the baseline specification (Table 3, col. 5). Under different specifications, disability decreases (same indiv. and HH characteristics but individual, year FEs and state FEs), while physical pain increases (same indiv. and HH characteristics, but individual FEs, industry-year FEs and state-year FEs).

The dependent variable in panels (b) and (c) is the number of doctor visits. Panel (b) shows similar results to Table 3, now with a weight fixed in a base year. Panel (c) controls for individual-industry fixed effects and shows that the effect of both Chinese and EE competition is not significantly different from zero, so there may be bias from the sorting of individuals into industries.

Panel (d) runs the analysis with Eastern European (EE) import competition. Results are similar but smaller in magnitude, though no effect is found on chronic illness. The baseline estimation for EE competition uses the same specification in Table 3, col. 5. All coefficients reported are estimated by FEIV. Clustered standard errors between workers within the same industry and state are reported in brackets.

Results for the alternative health outcomes are consistent with baseline. As with health care utilization measured in annual doctor visits, Chinese import competition worsens also individual outcomes related to general health and well-being. Specifically, with an increase of EUR 100 in Chinese import exposure (i.e. a change within 1.55 standard deviations of mean Chinese import exposure), the probability of developing chronic illness increases by 5.2 percentage points (equivalent to 18.4 per cent on average), while sport frequency decreases by 5.1 percentage points (or 11.6 per cent on average). Similarly, the probability of experiencing physical pain increases by 5 percentage points (or 17.4 per cent) due to Chinese import competition.

The probability of being *disabled* [5] diminishes by 0.6 percentage points (or 11.2 per cent on average) with higher Chinese competition. Counterintuitively, this may also be consistent with results on health care utilization, chronic illness and general health: (1) officially 'disabled' status may be more difficult to obtain and people are pushed into developing other medical issues, possibly chronic illness; (2) health and safety checks increased over time which lowered the number of work accidents, and therefore the number of disabled people, but this does not necessarily imply that people are doing better in terms of health and well-being.

Baseline estimation using a base-year weight

Adapting the first ratio in equation (1), import exposure is now weighted by a ratio held constant in a base year, so that the yearly variation is given by variation in the import shock ratio only. This can be written as follows:

$$IE_{jkt} = \frac{E_{j,k,base\,year}}{E_{j,base\,year}} * \frac{M_{kt}}{E_{kt}} \qquad (4)$$

With this new formulation, the sign of the coefficient on import exposure remains positive and significant, and estimates are marginally lower (Table 4, panel b). The estimation includes the

same controls as in Table 3, col. 5. Standard errors are robust and are clustered for workers at industry-state level.

Sorting

Table 4 panel (c) runs the baseline specification with individual-industry fixed effects and finds that the coefficient of interest on Chinese import competition becomes insignificant. This hints that there may be significant bias from the sorting of individuals into industries. That is, individuals may choose an industry according to the degree of well-being that they expect to derive. Considering findings in this paper, these may be industries that are less exposed to import competition. Standard errors are robust and are clustered between workers within the same industry and federal state.

Exposure to imports from Eastern Europe

According to Dustmann et al. (2014), the remarkable economic transformation that Germany underwent from mid-1990s throughout early 2000s was in part possible due to trade integration with Eastern Europe. Due to its proximity and shift from central planning, Eastern Europe (EE) represented a source of cheap import goods allowing Germany to specialize in the automotive and steel industries.

Consequently, as with Chinese imports, Table 4 panel (d) runs the analysis with EE imports, and constructs an import exposure measure as in equation (1) while instrumenting as in equation (2). The Eastern European countries considered here are Poland, Hungary, the Czech Republic, Slovakia and Romania, as these countries form a geographical corridor and share a similar history in the aftermath of WWII until the Fall of the Berlin Wall. Thus, EE import exposure amasses five countries, and imports from these countries into Australia, Canada and Japan isolate the supply-driven component of EE imports.

Estimates are consistent with findings for Chinese imports in terms of sign and significance, but effects are considerably smaller when considering EE imports (Table 4, panel d). Contrary to Chinese competition, which affects high-tech and medium-high tech German manufacturing industries, EE competition affects primarily medium-low and medium-high technology sectors (classified as in Eurostat, 2018d). The differential in international competitiveness may explain the smaller effects obtained with EE import competition, and this is not surprising in most innovation-driven economies such as Germany or the US.

Heterogeneity

Table 5 tests if there is consistency of the observed relation across different subgroup of individuals. Here, Chinese import exposure is interacted with a series of dummies for female, education level, short and long tenure with current employer and various levels of technological intensity according to the industry of occupation, e.g. if working in a medium-low or high technology industry (Eurostat, 2018d).

Results are consistent with baseline. The coefficient on Chinese competition stays positive and significant at a 1% level. Notably, the effect of Chinese import penetration on healthcare utilization is larger for (a) female workers, (b) individuals with lower levels of educational attainment and (c) workers that have held a long tenure with their employer. Interestingly, the effect is relatively smaller (i.e., individuals visit the doctor less) for workers who have been with their employer for less than five years or those who work in technologically competitive sectors typically affected by Chinese import penetration. This discrepancy fuels a discussion in Section 5.

TABLE 5 Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
IE China	1.126***	1.187***	1.036***	1.169***	1.052***	1.071***	1.283***
	[0.394]	[0.383]	[0.387]	[0.394]	[0.373]	[0.414]	[0.479]
IE x Female	-0.203						-0.086
	[0.470]						[0.478]
IE x Ed.(<HS)		-1.154**					-1.139**
		[0.481]					[0.487]
IE x Ten 0-5 yrs.			0.131				0.043
			[0.300]				[0.323]
IE x Ten 11-20 yrs.				-0.341			-0.283
				[0.356]			[0.384]
IE x Medlow Tech					-1.736		-1.594
					[1.710]		[1.717]
IE x High Tech						-0.003	-0.122
						[0.661]	[0.664]
Dummy < HS		0.554					0.586
		[0.513]					[0.514]
Dummy 0-5 yrs tenure			-0.679***				-0.637***
			[0.237]				[0.250]
Dummy 11-20 yrs tenure				0.307			0.153
				[0.247]			[0.262]
Obs.	55039	55039	55010	55010	55039	55039	55010
KP F-stat	1123.9	752.5	1370.2	2766.8	589.5	5645.2	337.8

* p<0.10, ** p<0.05, *** p<0.01

The dependent variable is annual visits to the doctor. IE China is the monetary exposure to Chinese imports for an employee working in region *j* industry *k* at time *t*.

Each column runs the baseline specification and adds interaction terms between import exposure and several variables. Variables in interactions with Chinese competition are dummies for female, educational attainment (less than high school), short tenure (0-5 years with current employer), long tenure (11-20 years), dummies for technological intensity (if working in a medium-low technology or a high-tech mfg. industry). Col. 7 includes import exposure and all interactions in cols. 1 to 6 with their instruments.

All regressions include the same controls as in Table 3, column (5). The coefficients reported are estimated by FEIV. Clustered standard errors between workers within the same industry and state are reported in brackets.

4.3 Potential Mechanisms

This section examines the pathways through which trade liberalization may affect individual health. In this reduced form analysis, Chinese import competition affects individual health indirectly via labor market conditions.

Estimates in Table 6 below show effects of Chinese import competition on several individual labor market outcomes. The labor market variables under consideration are (1) the probability of being registered as unemployed and receiving unemployment benefits (i.e. a dichotomous variable referred to as 'job displacement' hereafter); (2) job insecurity, a dichotomous variable which signals if the individual is concerned with job security; (3) the probability of changing occupation, also dichotomous; (4) reliance on social assistance, given by the probability of being registered for social assistance benefits[6]; (5) hourly wage, computed as the ratio of annual labor earnings to annual work hours; and (6) satisfaction with personal income, dichotomized and equal to 1 if the individual rates their own satisfaction with any score from six to ten, and 0 otherwise (see legend in Table 6 for more details).

Variables in columns (2) and (6) are based on the perception of the individual, whereas the other variables are still self-reported but provide more objective measures of the individual's labor market outcomes. When considered together, though, all variables provide information on the German labor market conditions and general job security following trade liberalization.

Conditional on the same set of controls used in the baseline, Table 6 columns (1) to (6) show that Chinese import competition worsens labor market conditions. First, German workers are 2.3 percentage points more likely to be displaced from their jobs (with receipt of unemployment benefits). On mean probability of being registered as unemployed and receiving benefits, this is equivalent to 52.5 per cent and constitutes an important new finding. Second, job insecurity (column 2) increases by 2.9 percentage points (or 4.8 per cent on average) while the probability

of changing occupations (column 3) increases by 2.5 percentage points, or 19.9 per cent on sample mean job change probability. Also, individuals are 0.4 percentage points more likely to rely on social assistance benefits (column 4), or 71.2 per cent on average. Other effects include a negative income effect due to higher import competition, which translates into a 0.47 EUR (or 2.9 per cent) decrease on mean hourly wage (column 5), coupled with a 3.0 percentage points decrease in individuals' satisfaction with personal income (column 6).

Overall, the effects obtained in Table 6 columns (1) to (6) signal an increased reliance on welfare benefits, greater job insecurity and reduced economic opportunity for individuals in import-competing manufacturing sectors. Accordingly, it is reasonable to assume that trade-induced German labor market conditions can therefore affect individuals' health.

Consequently, as a further robustness check, Table 6 now includes all labor market variables used in columns (1) to (6) and repeats the reduced-form estimation with annual doctor visits and the probability of developing chronic illness as dependent variables (columns 7 and 8, respectively). Compared to baseline, estimates are robust but indicate a decrease in the number of annual visits to the doctor – from 1.07 to 1.0 visits, or from 14.3 per cent to 13.4% on average – and a significant increase in the probability of being diagnosed with chronic illness – from 5.2 to 5.8 percentage points, meaning from 18.4 to 20.6 per cent, on average.

Given that individuals are also more likely to report physical pain (as per Table 4, panel a), a reduction in health care utilization coupled with an increase in the probability of developing chronic illness suggests that health behavior and individual choice to seek healthcare may be mediated by trade-induced labor market conditions. If this means also hindering individuals to seek healthcare when they should, then it is likely to carry hefty economic implications considering the past years' surge in the costs of health care in Germany, especially for preventable causes of disease.

TABLE 6 Potential Mechanisms

	Job displacement	Job insecurity	Occup. change	Social assist.	Hourly wage	Satisf. with pers. income	All lab. mkt var. doctor visits	All lab. mkt. var. chronic illness
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IE China Coeff.	0.023***	0.029*	0.025**	0.004**	-0.474**	-0.030*	1.000**	0.058**
	[0.006]	[0.017]	[0.013]	[0.002]	[0.203]	[0.016]	[0.466]	[0.029]
KP F-stat	6402.8	6225.7	6346.1	6405.7	6220.1	4882.2	4609.5	1641.6
First stage	0.059***	0.059***	0.060***	0.060***	0.060***	0.054***	0.054***	0.051***
	[0.0007]	[0.0008]	[0.0007]	[0.0007]	[0.0008]	[0.0008]	[0.0008]	[0.001]
Obs.	55039	54222	54859	55039	53290	37106	35190	14468

* p<0.10, ** p<0.05, *** p<0.01

The dependent variables are columns (1)-(6) on the RHS. The first row reports the coefficient on Chinese import exposure. The dependent variable in column (7) is annual doctor visits, as per Table 3, col. (5). The dependent variable in column (8) is chronic illness, as per Table 4, panel a.

Col. (1) gives the coefficient estimates of import competition on job displacement, a dichotomous variable which equals 1 if the individual is registered as unemployed and claiming unemployment benefits, and zero otherwise.

Col. (2) is a dichotomous variable equal to 1 if the individual is very concerned or somewhat concerned about job security, and zero if not concerned at all.

Col. (3) gives the estimates for occupational change, a dichotomous variable which is equal to 1 if the individual experienced previous occupational changes, and zero otherwise. Retrieved from the GSOEP question on occupational changes (Table A.3 in the Appendix), where "employed with change" accounts for 13% of this sample.

Col. (4) reports results for a dichotomous variable which equals 1 if the individual receives social assistance. Social assistance in Germany (*sozialhilfe*) is given to all employable people in need who are unable to work and have no entitlement to unemployment benefit as well as to people over the age of 65 who are in need.

Col. (5) is average hourly wage, i.e. annual labour earnings divided by annual work hours.

Col. (6) reports results for a dichotomous variable which equals 1 if the individual rates satisfaction with their personal income with any score from 6 to 10 and equals zero if the score is 0-5.

Col. (7) runs the baseline specification from Table 3 col. (5) with all labour market variables in col. (1) to (6).

All regressions include the same controls as in Table 3, column (5). The coefficients reported are estimated by FEIV. Clustered standard errors at industry-state level in brackets.

5. Discussion: An estimation of health care expenditure with chronically ill manufacturing workers

This section puts into perspective the findings in this paper and eventually performs a back-of-the-envelope calculation regarding the healthcare costs of falling ill among German manufacturing workers, currently a fifth of the German labor force.

First, findings suggest that workers on short tenures visit the doctor less, similarly to those in technologically competitive manufacturing sectors subject to Chinese import competition. Moreover, when factoring in job insecurity and labor market mechanisms, results also show that import competition from China reduces annual doctor visits but increases the probability of chronic illness (Table 6, columns 7 and 8).

It is therefore plausible that trade-induced job insecurity and labor market conditions play a role in altering health behavior and subsequently lead to undesired outcomes in terms of health care utilization and chronic illness. Previous German evidence documenting *presenteeism* – which is when workers who may feel compelled to show up at work though feeling ill or unfit for work – indicates that about 60-70 per cent of employees go to work while feeling ill, with one third going to work despite doctor's advice to stay at home (Zok, 2008). Additionally, Kim et al. (2016) argue that job insecurity increases the risk of presenteeism. Also, the legal framework and contractual terms seem to affect how employees behave. To this effect, Zok (2006) and Parli (2018) further add that, if there is a lack of strong legal employee protection from dismissal in case of sickness, it is not surprising that employees tend to engage in presenteeism based on the fear of losing their job.

Second, there seems to be a trade-off relationship between disability and chronic illness, as individuals do not tend to become disabled but are more likely to develop some chronic disease due to higher import competition (Table 4, panel a). In discussing health behavior, it also makes

sense to review attitudes towards illness, particularly stigma towards disabled people, which remains high in Germany. For instance, Fiala (2018) points out that the German labor market remains exclusionary and discriminatory towards people with disabilities, despite comprehensive anti-discrimination legislation. Ruesch et al. (2005) distinguish between different mechanisms of stigmatization, among which they identify public discrimination and structural discrimination by private and public institutions that intentionally or unintentionally restrict opportunities to disabled people. Hence, consistent with the findings on presenteeism, effects on disability are not surprising as workers may feel compelled to work more when faced with foreign competition, especially since the level of stigma remains preponderant in public opinion and current legislation may not protect ill workers to the fullest ramifications of this stigma.

To some extent, the trade-off between disability and chronic illness may be a positive externality if and only if chronic disease management is preventive in scope and does not entail hefty consequences for public health and the costs of healthcare in the long run. For this to happen, policy needs to accommodate a new dimension of effectiveness in chronic care, one that monitors and prevents structural changes associated with eventually harmful attitudes to work, health and illness in a globalizing world.

Based on results in this paper, a back-of-the-envelope calculation suggests that if Chinese import competition increases the probability of developing chronic illness by roughly 19.5 per cent (average of 18.4 and 20.6 per cent) and there are 7.4 million manufacturing workers in Germany, then associated costs of healthcare at a mean of EUR 4,944 per inhabitant will be roughly 7.1 billion, or in the range of EUR 6.7 billion to 7.5 billion. That is, a yearly increase of 1.7 per cent compared to the 2019 health spending, without considering a higher average

cost of care per inhabitant for chronic patients. The figure coincides with a similar calculation by Colantone et al. (2019) for the UK.

Interestingly, when factoring in labor market conditions, this trade-off between health care utilization (measured as doctor visits) and chronic illness somewhat mirrors the trade-off between chronic illness and disability. So, there must be a structural element of public policy or of public opinion that, by design or by acquired health behavior, does not allow individuals to visit the doctor when needed, and instead pushes individuals into chronic illness from both sides. That is, unable or unwilling to register for disability and slowly pushed into chronic illness, or unable to visit the doctor when needed due to highly competitive working conditions and greater job insecurity and ending up with chronic illness as a result.

6. Concluding Remarks

This paper studies the effect of Chinese import competition on the health and labor market outcomes of individuals working in the German manufacturing sector. I find that higher import competition negatively affects individual health by raising the number of visits to the doctor and the probability of developing physical illness. Individuals are 18.4 to 20.6 per cent more likely to develop chronic illness and increase their visits to the doctor by 14.3 per cent, but they are also more likely to experience physical problems and exercise less frequently upon higher import competition from China. Counterintuitively, individuals do not tend to become disabled, but this may point to a trade-off relationship between disability and chronic illness, as individuals are slowly pushed into chronic illness.

Furthermore, potential mechanisms mediating the health effect of import competition are related to the labor market outcomes of German workers. Chinese imports are likely to rise the individual probability of job displacement, job insecurity and take-up of benefits. Specifically, individuals are more likely to registering for unemployment and social assistance benefits, and experience job insecurity and occupational change, while having reduced earnings and satisfaction with personal income.

Recent health policy in reunified Germany has aimed at reducing the variation of care through disease management programmes. However, most models and elements used in chronic disease management rely on integrated care but do not explicitly focus on multi-morbidity (Struckmann et al., 2018). Faced with a demand for healthcare without precedent, post-pandemic health policy in innovation-driven economies should consider the distinct level of complexity that trade adds to health care management.

Attempting to fix either of the sides – health, trade or anywhere along the spectrum between the two – will continue to be suboptimal until health policy considers socio-economic inequalities as a structural element in the design of sustainable health plans in a globalized economy. If the aim is to close the divide in the utilization of public and private healthcare services, then sustainable health policy and planning should consider the individual reasons to seek care in vulnerable working segments of population as totally preventable costs of healthcare. This will prevent and safeguard both individuals and health care providers against deeper, long-term implications of dealing with these costs.

With globalization, attitudes to work and health are changing in line with different labor market conditions, social norms, market expectations and individual future orientation. Despite efforts, health inequalities in Germany have arguably been addressed only to some extent. Besides usual determinants, there may be other potential sources of health inequalities that are partly rooted in individuals' attitudes to work and health, and partly determined by current labor market conditions subject to exogenous shocks and structural change following trade liberalization. However, these two realms seem to overlap in the context of globalization, so individuals may lose out in terms of health and well-being and effects may be persistent. A work culture focused on productivity might be resistant to health reform efforts that do not deeply integrate primary care with preventive habit formation.

For globalization to reverse the negative health outcomes of individuals in advanced economies, we need a further strengthening of the market principles involved in the operation of the labor market in the context of a globalized world. To this effect, public health policy advocates must be enabled to decide and advise early on against ramifications of health models that are or become unsustainable and eventually cost individuals and national budgets too much. Besides training and direction, achieving this necessarily requires congruence between

individual, social and institutional factors to instill an incentive to safeguard health and reduce the variation of care.

Most importantly. the future design of public health policy must reciprocate the individual's system of values with preventive measures that do not only enhance current employment protection schemes and working conditions but also envisage intuitive, early personalized health plans as a form of preventive primary care.

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Data Availability Statement

Data from the German Socio-Economic Panel (G-SOEP) used in this study are owned by the German Institute for Economic Research (DIW Berlin) and are available upon request from DIW Berlin. Regional and industry-level employment levels as well as data on imported manufactured goods come from publicly available sources. Computations using public data and further details will be made available following reasonable request from authors interested in replicating the analysis.

Notes

1 The 2000 Health Care Reform Act formally aimed at reducing health inequalities (Busse and Riesberg, 2004) by means of a risk compensation scheme formerly introduced in 1994. Yet, it also revealed great reluctance from Social Health Insurance (SHI) funds, an income-dependent contribution system to finance health care coverage, to invest in chronic disease care. To this end, to further reduce the variation of care, Disease Management Programmes (DMPs) where rolled out nationwide in 2002, and subsequent legal and financial changes allowed to establish integrated care as a distinct sector (Busse and Riesberg, 2004), relying primarily on a morbidity-adjusted risk compensation scheme.

2 The mapping was performed as per the World Integrated Trade Solutions convergence tables (WITS, 2018), and the RAMON (Eurostat, 2018b) for the instrument of import exposure.

3 This is obtained based on the universe of all SOEP employees who ever worked in a manufacturing sector for at least one year, then labour market transitions have been computed for all pre-sampled individuals and a time-invariant is industry is assigned to individuals who change sector to either services or non-employment while reverting to the time-variant industry for those who switch between manufacturing industries (see intersectoral mobility Tables A.1 and A.2 in the Appendix).

4 Besides the same individual and household controls, estimations with physical pain includes individual FEs, industry-year FEs and state-year FEs. The estimation for disability includes individual FEs, year FEs and state FEs. The various specifications are detailed in the brackets besides each alternative in Table 4, panel (a). Standard errors are robust and clustering for workers is at industry-state level.

5 ‘Disabled’ status is given subject to medical assessment in Germany. Table A.3 question number 4 in the Appendix details that SOEP respondents receive ‘disabled’ status subject to official medical assessment. Any disability benefits are given depending on the degree of disability, years of contribution and a 5-year qualification period (Deutsche Rentenversicherung, 2019).

6 Social assistance in Germany (*sozialhilfe*) is given to all employable people in need who are unable to work and have no entitlement to unemployment benefit as well as to people over the age of 65 who are in need.

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Appendix

TABLE A.1 Labour market transitions

Origin t-1	Destination *t*	Manuf (%)	Services (%)	Non-employment (%)
1995	1996	89.16	10.29	0.56
1996	1997	80.91	18.61	0.48
1997	1998	83.04	16.35	0.61
1998	1999	89.81	9.90	0.28
1999	2000	78.48	17.96	3.57
2000	2001	90.09	9.10	0.82
2001	2002	81.0	18.23	0.77
2002	2003	90.01	8.96	1.03
2003	2004	81.11	17.46	1.43
2004	2005	90.97	7.31	1.72
2005	2006	91.97	6.93	1.09
2006	2007	83.50	15.26	1.24
2007	2008	92.17	6.36	1.47
2008	2009	80.56	17.89	1.55
2009	2010	88.79	8.73	2.48
2010	2011	83.97	13.65	2.38
2011	2012	87.25	11.54	1.21
2012	2013	80.72	17.53	1.75
2013	2014	90.19	8.53	1.29
2014	2015	80.23	18.56	1.21
2015	2016	90.98	8.33	0.69
No. people				n=13,980

Intersectoral mobility is calculated for each year (origin and destination year) across all workers, both males and females.

The number of all workers that have ever worked in manufacturing for at least one year in the panel period is 13,980.

The probability of staying in manufacturing in the next period is roughly 90% over time. For example, 89.2% of the people working in manufacturing in 1995 are likely to stay in manufacturing in 1996, with 10.3% moving to services and 0.56% moving into non-employment (inactive, unemployed).

The next most likely destination of manufacturing workers in the next period is services. These transition probabilities have been computed for *all* individuals who had worked in manufacturing at least once in the panel period before obtaining the final sample with time-invariant manufacturing industries for those that left manufacturing.

TABLE A.2 In-out manufacturing transitions probabilities

Origin *t-1*	Destination *t*	Stay in manuf (%)	Stay outside manuf (%)
1995	1996	90.35	81.10
1996	1997	81.68	94.27
1997	1998	88.62	87.32
1998	1999	90.77	80.93
1999	2000	79.89	94.71
2000	2001	92.55	67.71
2001	2002	81.35	93.10
2002	2003	91.02	85.43
2003	2004	81.36	95.07
2004	2005	91.44	77.62
2005	2006	91.83	94.74
2006	2007	83.93	90.41
2007	2008	92.06	81.84
2008	2009	81.73	94.39
2009	2010	88.83	81.10
2010	2011	81.64	77.88
2011	2012	86.90	76.22
2012	2013	83.45	83.82
2013	2014	91.51	83.34
2014	2015	80.18	91.47
2015	2016	90.85	76.04
No. people			n=13,980

The probability of staying in manufacturing is calculated for each year (origin and destination year) across all workers.

The number of all workers that have ever worked in manufacturing for at least one year in the panel period is 13,980.

The probability of staying employed in manufacturing in the next period is generally very high, roughly 90% over time. On the other hand, the probability of someone outside manufacturing staying outside manufacturing in the next period is also high, except for 5 years in the panel period when it drops below 80%, but never below 65%.

TABLE A.3 Health Questions in the GSOEP Individual Questionnaire

Question	Answer/Scale	Obs.
1. Have you gone to a doctor within the last three months? (GSOEP annualises the variable based on the number recorded here)	Yes (states number) No (marks 0)	57,702
2. How often do you exercise?	Almost never (1)/Sev. times a yr (2) >=1 per month (3)/>=1 per week (4)	33,756
3. Have you been suffering from any conditions or illnesses for at least one year or chronically?	Yes (1) / No (0)	17,840
4. Have you been officially assessed as being disabled for medical reasons?	Yes (1) / No (0)	57,671
5. During the last four weeks, how often did you have physical pain?	Always (1)/Often (2)/Sometimes (3) Almost never (4) / Never (5)	21,287