No Pain, No Gain: The Effects of Exports on Job Injury and Sickness

David Hummels, Purdue University
Jakob Munch, University of Copenhagen
Chong Xiang, Purdue University
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Motivation

- Globalization and labor-market outcome. E.g. Verhoogen 2008 (QJE), Autor, Dorn and Hanson 2012 (AER), Hummels, Jorgensen, Munch, and Xiang 2014 (AER), and many others.

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- We ask, how do exports affect individual workers' health

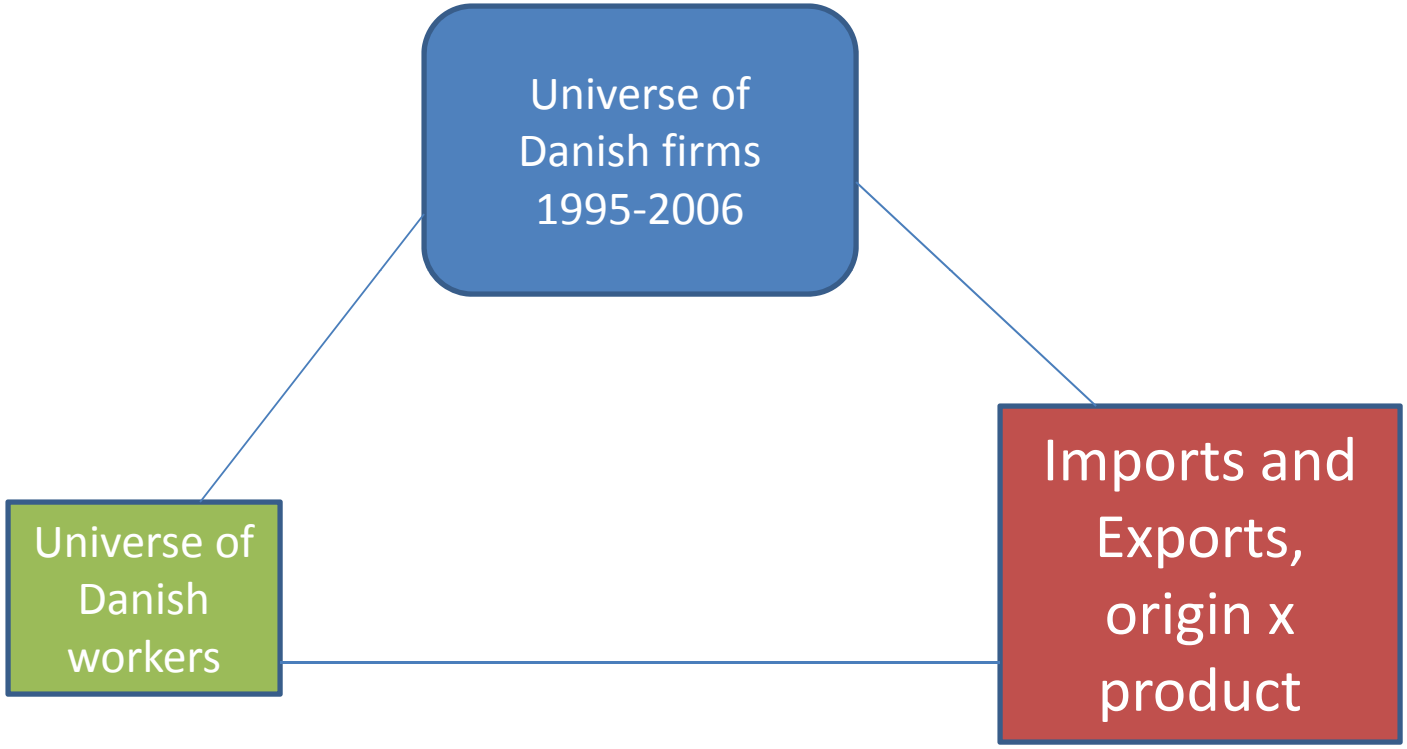
Why Do Exports Affect Health?

- Exports rise for a firm => Its Workers Choose More Efforts
- Medical research:
  - High work intensity associated with higher blood pressure, higher cortisol level, more depression, higher probability of heart disease, strokes and even death (e.g. Virtanen et al. 2012, O'Reilly and Rosato 2013, Kivimaki and Kawachi 2015)
- Therefore, exports rise for a firm => adverse health outcome for the workers

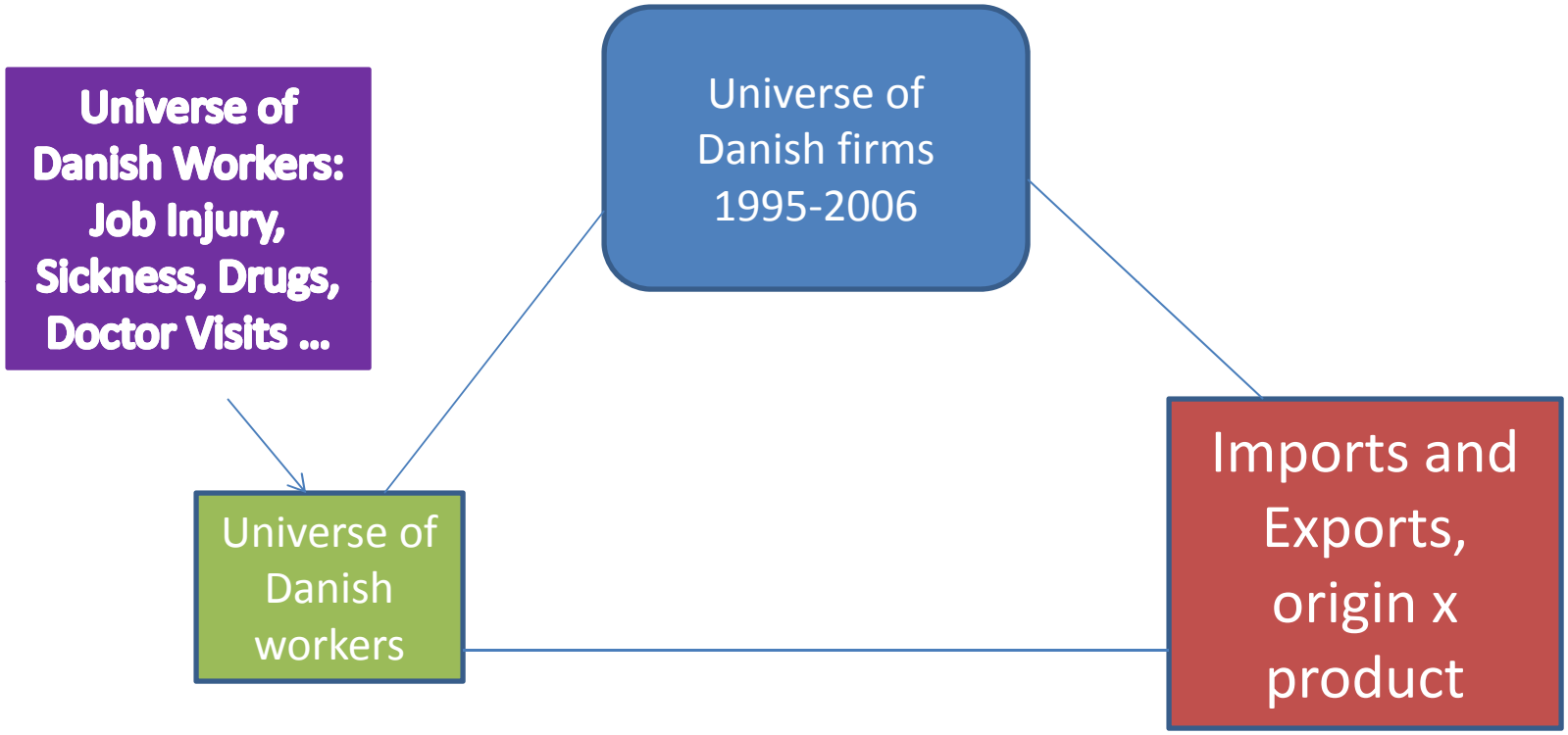
Outline

- Data
- Theoretical framework
- Empirical specification
- Results
- Injury rate during Great Trade Collapse
- Pain vs. gain from exports

Danish Data, Matched Firm-Worker-Trade



Merge in Data on Individual Workers' Health



Danish Health Care

- Virtually universal & free. Funded by the government.
- All individual interactions with Danish Health Care system are carefully recorded

- All have access. Comparison: studies using U.S. data (e.g. Currie and Madrian 1999)

Severe Depression

- Dummy for anti-depressant drugs

	Obs	Mean	Std. Dev.
All	1955728	0.0294	0.17
Men	1306140	0.0243	0.15
Women	649588	0.0395	0.19

- Dummy for anti-depressants or visiting a psychiatrist

Other Prescription Drugs (Dummies)

	Obs	Mean	Std. Dev.
Sleep Disorder	1955728	0.0232	0.15
Anti-thrombotic agents	1955728	0.0170	0.13
Other Heart Diseases	1955728	0.0057	0.08

Hospitalization (Dummies)

	Obs	Mean	Std. Dev.
Sleep Disorder	1955728	0.0006	0.024
Heart Attacks or Strokes	1955728	0.0006	0.024
Poisoning, Self-Harm, or Assault	1955728	0.0015	0.038

- Broader effects of import competition (e.g. Autor, Dorn, Hanson and Song 2013, McManus and Schaur 2014, Dix-Carneiro, Soares and Ulyssea 2015)

Job Injury

- Reviewed by National Board of Industrial Injuries (NBII)
- Reject (44%). Accept with no compensation (28%). Accept with compensation (22%).
- Dummy for accept with compensation (permanent damage to working ability).

	Obs	Mean	Std. Dev.
Injury Dummy	1955728	0.00389	0.062

- Comparison: studies using U.S. data (e.g. Campolieti and Hyatt 2006, Viscusi and Aldy 2003)

Work Hours

- Sub-sample: over-time hours
- Total hours = regular + over-time hours

	Obs	Mean	Std. Dev.
Overtime Hours (count)	1161807	50.623	116.514
Total Hours (count)	1163794	1532.60	365.04

Sick-Leave Days

- Exact dates of sick leave, drug purchase and doctor visits
- Minor sick days: sick-leave but no drug purchase or doctor visit
- Major sick days: others

	Obs	Mean	Std. Dev.
Major Sick Days (count)	1955728	6.11	30.61
Minor Sick Days (count)	1955728	0.21	2.64

- Comparison: previous studies on shirking/efforts (e.g. Ichino and Maggi 2000, Hesselius et al. 2009)

Literature Using Panel Data

- Economics
  - Plant closures/mass layoffs on mortality & hospitalization (e.g. Sullivan and von Wachter 2009, Eliason and Storrie 2009, Black et al. 2012, and many others)
  - Others using Danish Data (e.g. Dahl 2011, Browning and Heinesen 2012, and many others)
- Outside of Economics
  - Framingham heart studies (e.g. Hubert et al. 1983, and many others.)
  - Whitehall Studies (e.g. Bosma et al. 1997, Marmot et al. 1997, Brunner et al. 1996, and many others)

Theoretical Framework

- Workers capture a fraction of surplus in multi-lateral bargaining (e.g. Helpman, Itskhoki and Redding 2010)
- MB=MC => optimally chosen effort level
- Rising exports = Rise in output demand

  => MB rises

  => Efforts rise

Bargaining Model Predicts

$$\ln e_{ijt} = \beta_1 \ln X_{jt} + \beta_2 F_i \ln X_{jt} + \mathbf{x}_{it} b_1 + \mathbf{z}_{jt} b_2 + \mathbf{x}_{it} \mathbf{z}_{jt} b_3 + \alpha_{ij} + \alpha_R + \alpha_{IND,t} + \varepsilon_{ijt}$$

- i=worker, j=firm, t=year.
- e=effort, X=export, F=female dummy

We Estimate

$$IOS_{ijt} = \beta_1 \ln X_{jt} + \beta_2 F_i \ln X_{jt} + \mathbf{x}_{it} b_1 + \mathbf{z}_{jt} b_2 + \mathbf{x}_{it}\mathbf{z}_{jt} b_3 + \alpha_{ij} + \alpha_R + \alpha_{IND,t} + \varepsilon_{ijt}$$

$$WK_{ijt} = \beta_1 \ln X_{jt} + \beta_2 F_i \ln X_{jt} + \mathbf{x}_{it} b_1 + \mathbf{z}_{jt} b_2 + \mathbf{x}_{it}\mathbf{z}_{jt} b_3 + \alpha_{ij} + \alpha_R + \alpha_{IND,t} + \varepsilon_{ijt}$$

- Consequences of effort = IOS_{ijt}: e.g. anti-depressants, anti-thrombotic agents, heart attacks and strokes, injury, and so on
- Proxy for effort = WK_{ijt}: total hours, sick-leave days

Challenges to ID

$$IOS_{ijt} = \beta_1 \ln X_{jt} + \beta_2 F_i \ln X_{jt} + \mathbf{x}_{it} b_1 + \mathbf{z}_{jt} b_2 + \mathbf{x}_{it} \mathbf{z}_{jt} b_3 + \alpha_{ij} + \alpha_R + \alpha_{IND,t} + \varepsilon_{ijt}$$

- Unobserved worker effects on health (e.g. Case and Paxton 2008) => α_{ij}
- X_{jt} is endogenous (e.g. Melitz 2003, Verhoogan 2008) => IV for X_{jt} following HJMX 2014 (AER)

Main Sample

- High export-sales ratio, high injury rate (Mfg., AgFish and Mining)

- Large Mfg. firms (>50 employees) that export, 1995-2006

  – About 2000 firms per year, 70% of manufacturing employment, 20% of private sector employment

  – 50% of total exports in Denmark

Results 1 Stress & Depression

N = 1,955,728	Anti. Dep. (Dummy)		Anti. Dep. Or Psych. (Dummy)	
	FE	FE-IV	FE	FE-IV
Log exports	-0.0006***	-0.0049**	-0.0007***	-0.0055**
	[-3.40]	[-2.08]	[-3.49]	[-2.19]
Log exports x female	0.0012***	0.0148***	0.0014***	0.0157***
	[2.77]	[3.87]	[2.94]	[3.90]
Married	-0.0051***	-0.0049***	-0.0064***	-0.0062***
	[-10.07]	[-9.74]	[-11.25]	[-10.91]

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Results 2 Other Diseases

Prescription Drugs for	(1)	(2)	(3)	(4)	(5)	(6)
	Sleep Disorder FE	Sleep Disorder FE-IV	Heart Disease FE	Heart Disease FE-IV	Heart Attack or Stroke FE	Heart Attack or Stroke FE-IV
Log exports	-0.0001	-0.0014	0.0002	0.0003	-0.0000	-0.0012
	[-0.52]	[-0.68]	[1.57]	[0.26]	[-0.00]	[-0.68]
Log exports x female	**0.0005***	0.0005	-0.0000	0.0009	-0.0002	**0.0089*****
	[1.85]	[0.16]	[-0.30]	[0.75]	[-0.84]	**[3.51]**

Hospitalization Due to						
	Sleep Disorder FE	Sleep Disorder FE-IV	Poisoning, Self-Harm or Assault FE	Poisoning, Self-Harm or Assault FE-IV	Heart Attack or Stroke FE	Heart Attack or Stroke FE-IV
Log exports	0.0000	0.0003	0.0000	-0.0003	0.0000	-0.0002
	[0.30]	[0.59]	[0.83]	[-0.81]	[0.15]	[-0.34]
Log exports x female	-0.0000	0.0003	-0.0001	-0.0006	-0.0000	**0.0013***
	[-0.11]	[0.81]	[-1.25]	[-1.10]	[-0.48]	**[1.90]**

Results 3 Injury

	FE	FE-IV
Log exports	0.0004***	0.0020*
	[4.09]	[1.71]
Log exports x female	-0.0001	-0.0017
	[-0.71]	[-1.42]

- Elasticity = 0.0020/0.0041=0.488.

Results 3 Injury

	Dep. Var = Injury Dummy			
	FE	FE-IV	FE	FE-IV
Log exports	0.0004***	0.0020*		
	[4.09]	[1.71]		
Log exports x female	-0.0001	-0.0017		
	[-0.71]	[-1.42]		
Exp.2q x male			-0.0004*	0.0003
			[-1.77]	[1.55]
Exp. 2q x female			-0.0002	0.0005**
			[-0.85]	[2.05]
Exp. 3q x male			0.0002	0.0005**
			[1.27]	[2.52]
Exp. 3q x female			0.0003	0.0006***
			[1.28]	[2.61]
Exp. 4q x male			0.0006***	0.0011***
			[3.41]	[4.34]
Exp. 4q x female			0.0004**	0.0011***
			[2.21]	[4.06]

Results 4 Log (Total Hours)

	Dep. Var. = log (Tot. Hours)			
	FE	FE-IV	FE	FE-IV
Log exports	-0.0072	-0.0071		
	[-1.14]	[-0.08]		
Log exports x female	0.0112*	0.1159*		
	[1.73]	[1.95]		
Exp. 2q x male			0.0266***	0.0220***
			[3.24]	[3.02]
Exp. 2q x female			0.0386***	0.0388***
			[5.30]	[5.57]
Exp. 3q x male			0.0327***	0.0311***
			[3.95]	[3.57]
Exp. 3q x female			0.0508***	0.0389***
			[6.49]	[4.61]
Exp. 4q x male			0.0009	-0.0042
			[0.08]	[-0.32]
Exp. 4q x female			0.0091	0.0142
			[1.03]	[1.39]

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Exp. 4q x female			0.0091	0.0142
			[1.03]	[1.39]

Results 5 Minor Sick-Leave Days

	Dep. Var. = #. Minor Sick-Leave Days			
	FE	FE-IV	FE	FE-IV
Log exports	0.0021	0.0316		
	[0.63]	[0.68]		
Log exports x female	-0.0054	-0.0282		
	[-1.03]	[-0.59]		
Exp. 2q x male			-0.0159**	-0.0179**
			[-2.18]	[-2.11]
Exp. 2q x female			-0.0136	-0.0189*
			[-1.51]	[-1.93]
Exp. 3q x male			-0.0306***	-0.0482***
			[-4.08]	[-5.47]
Exp. 3q x female			-0.0140	-0.0229**
			[-1.59]	[-2.18]
Exp. 4q x male			-0.0012	-0.0128
			[-0.18]	[-1.25]
Exp. 4q x female			-0.0063	-0.0180
			[-0.81]	[-1.57]

Results 5 Major Sick-Leave Days

	Dep. Var. = #. Major Sick-Leave Days			
	FE	FE-IV	FE	FE-IV
Log exports	-0.0175	-2.2137***		
	[-0.31]	[-3.18]		
Log exports x female	0.5403***	0.0910		
	[4.59]	[0.10]		
Exp. 2q x male			-1.0472***	-0.7396***
			[-6.79]	[-6.23]
Exp. 2q x female			-1.3747***	-0.5185***
			[-7.08]	[-2.75]
Exp. 3q x male			-0.6644***	-0.4284***
			[-5.85]	[-3.24]
Exp. 3q x female			-0.6795***	-0.1020
			[-3.71]	[-0.51]
Exp. 4q x male			-0.1329	0.7188***
			[-1.27]	[4.15]
Exp. 4q x female			1.0709***	1.9384***
			[6.61]	[8.93]

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Our Results Speak To

- Recession and mortality (e.g. Ruhm 2000, 2013, Stevens et al. 2011, Lindo 2013, Tekin et al. 2013, and many others)

- Egan, Mulligan and Philipson (2013)

07-09 Recession in Denmark

7/5/13 Diagram

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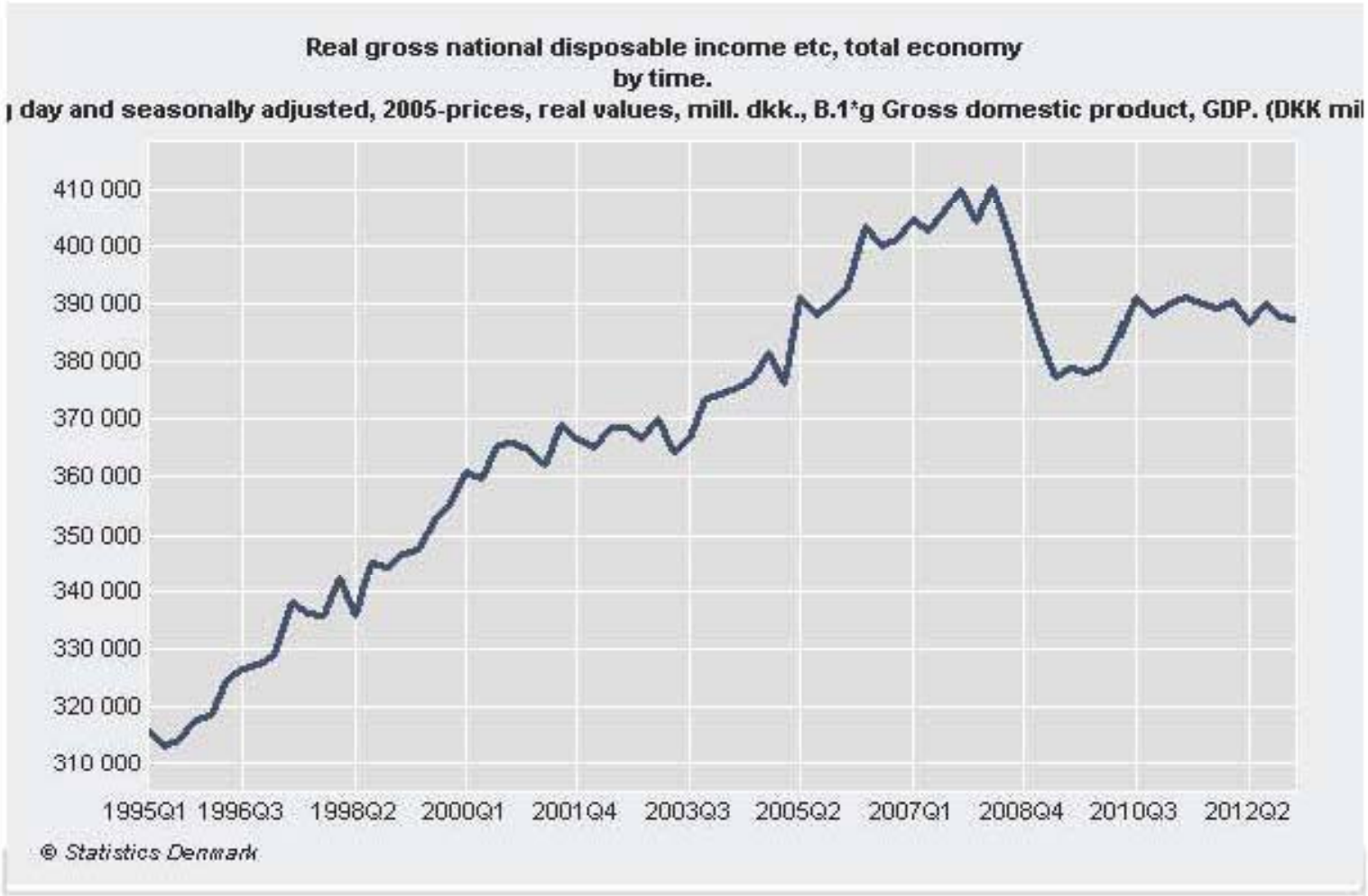
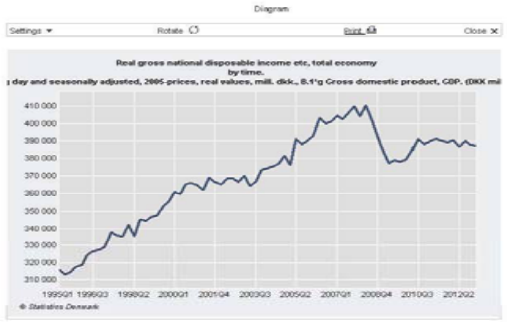
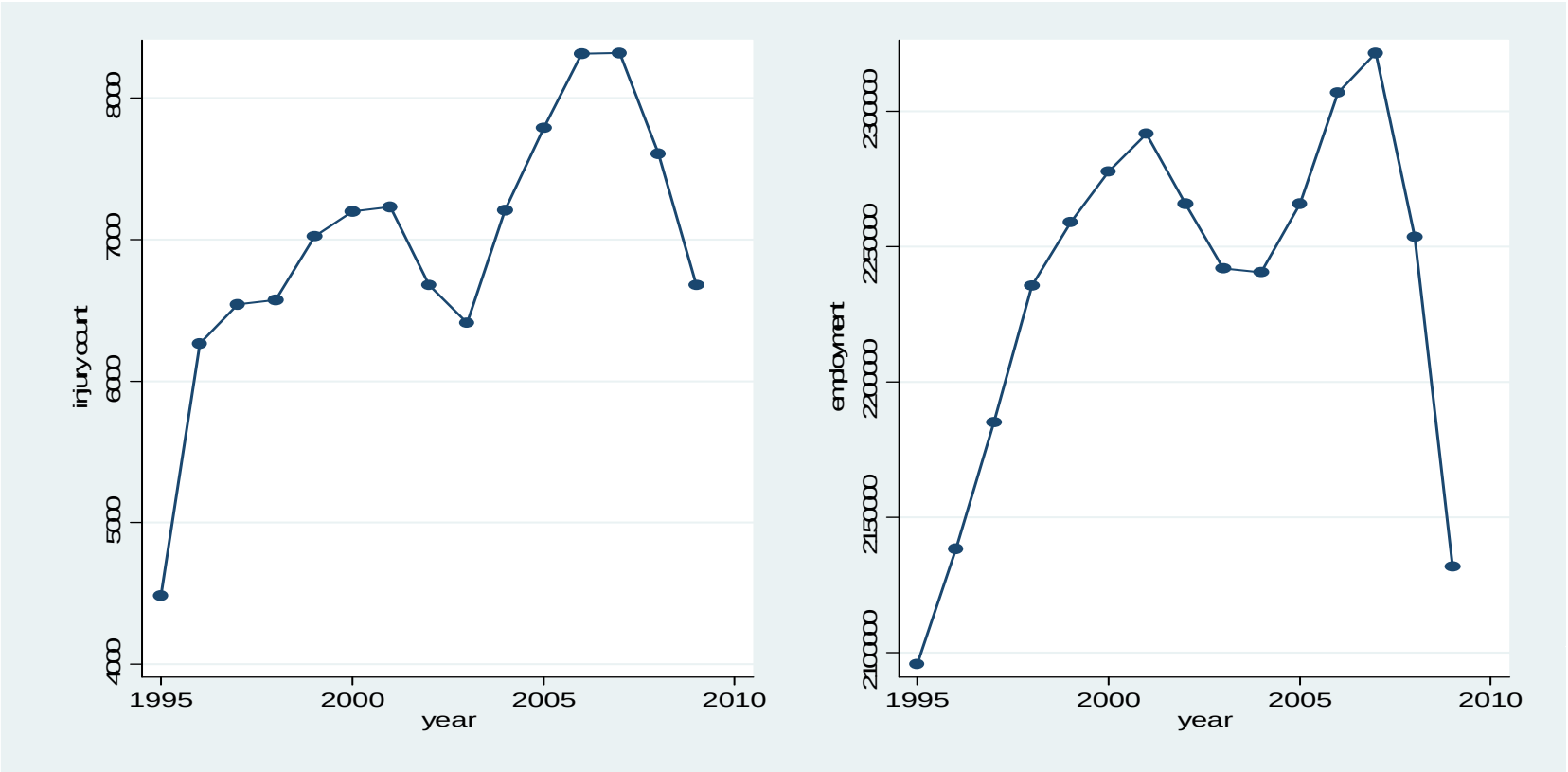
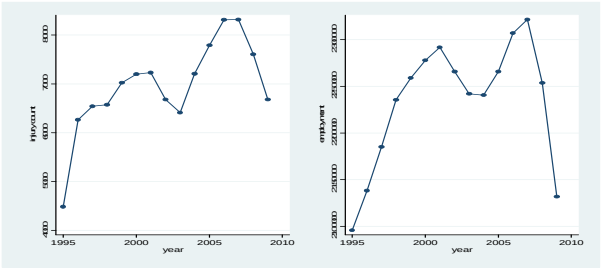


Injury Count & Employment in Recession



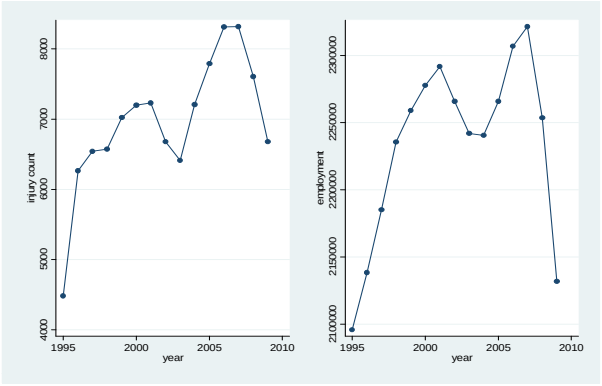


Injury Rate in Recession



Actual Reduction = 0.000451

Predicted Reduction in Injury Rate



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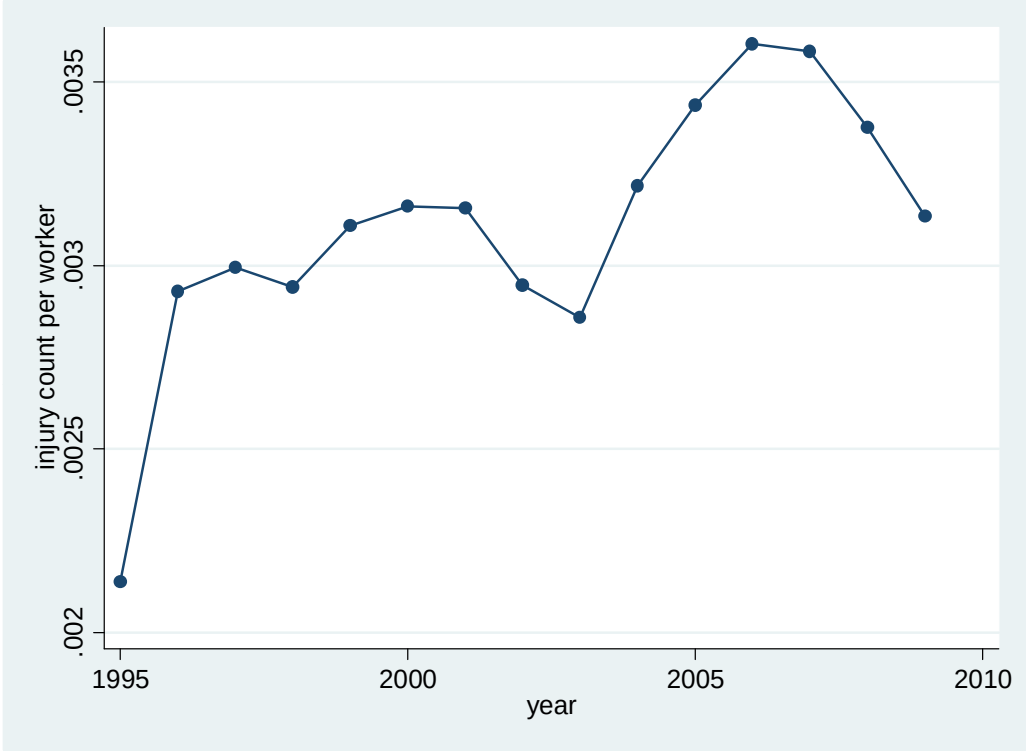
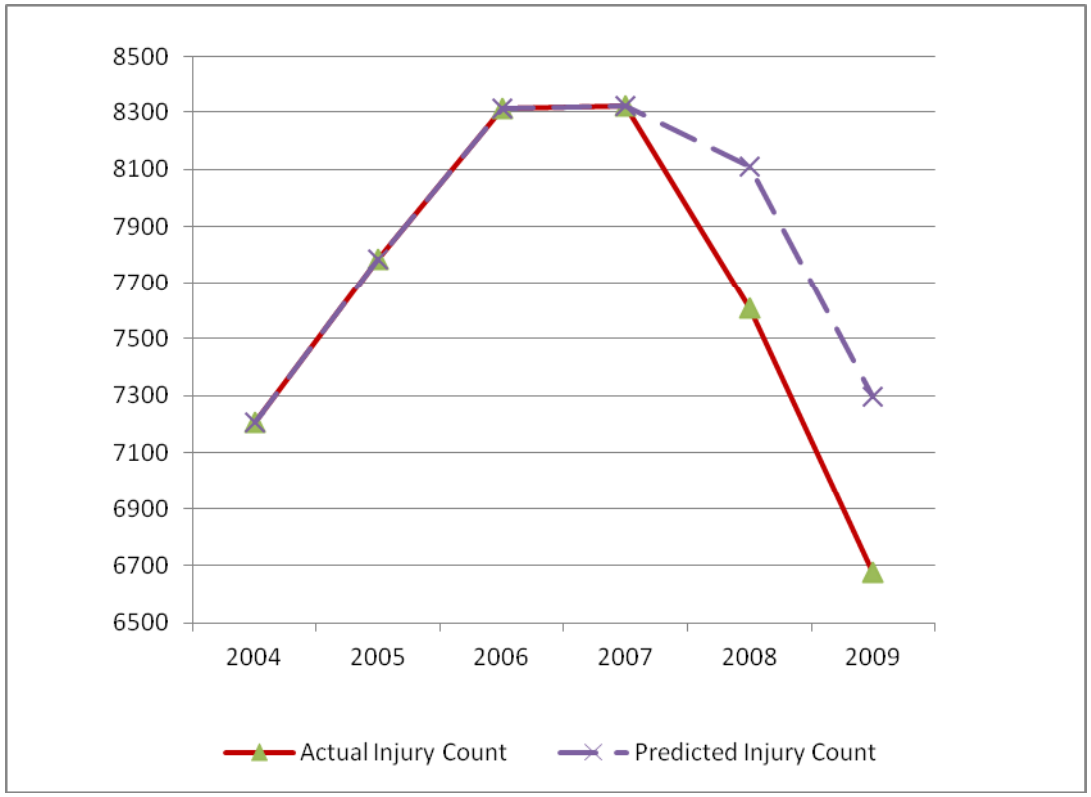


During 2007-2009, Danish exports decline by 17%.

Coefficient of export (FE-IV) = 0.00205

Predicted Reduction = 0.000349

Predicted Job Injury Counts



	Actual	Predicted	% Actual
Δ(Inj. Count), 07-09	1641	1025	62.44%

Pain vs. Gain

- Rising exports makes individual workers less healthy by increasing their injury and sickness rates
  - source of non-pecuniary welfare pain from globalization
- Rising exports lead to wage increases: pecuniary welfare gain (HJMX 2014)

We Develop Our Framework

- Injury and Mortality (e.g. Viscusi and Aldy 2002, Murphy and Topel 2003, Becker, Philipson and Soares 2005, and many others)
- Non-fatal Diseases
  - Economics: Finkelstein, Luttmer and Notowidigdo 2013
  - Outside of economics: DALY (Disability-Adjusted Life Years), Murray and Acharya 1997.

How Large is the Pain?

- The total welfare loss is
  - 4.2% of the wage gain for men and 18.8% of the wage gain for women

- Gains from trade (e.g. Arkolakis, Costinot and Rodriguez-Clare 2012, Melitz and Redding 2013, and many others)

As Exports Rise Exogenously by 10%

- Women's **rates** of anti-depressants, 2.51%, antithrombotic drugs, 7.7%, hospitalization due to heart attacks and strokes, 17.44%
- Women and men's injury **rate**, 6.35% & 4.68%
- Women and men: more work hours, less sick leave days
- Relative to wage gains, losses are 4.16% for men but 18.83% for women

Discussions

- Injury rates & counts in Denmark during 07-09
- Sigmund Freud, “Civilization and Its Discontents”
- Case and Deaton (2015)
  - suicides, drug & alcohol poisoning, liver diseases
  - Declines in mental health; midlife distress

Provision of Mental-Health Care?

Large U.S. Companies Have

Sum. Stats.: Sample vs. Population

	Full, 95-09		Mfg, 95-09		Sample, 95-06	
	Obs	Mean	Obs	Mean	Obs	Mean
Injury Dummy	33510639	0.0031	5503922	0.0041	1955728	0.0039
log (Hourly wage)	31299066	5.280	5234344	5.356	1955728	5.193
Married (Dummy)	33510639	0.525	5503922	0.541	1955728	0.586
Experience	33510591	15.524	5503919	16.906	1955728	17.863
Union (Dummy)	33510564	0.713	5503912	0.779	1955728	0.875

Instruments

- Need instruments that are
  - Correlated with exports
  - Uncorrelated with firm ability, injury risk

- Two instruments: world import demand (WID), fitted transportation costs (tc). These vary over time and across importers x products

- To get firm level variation, exploit pre-sample variation across firms in the products x destination countries

$$I_{jt} = \sum_{c,k} s_{jck} I_{ckt}$$

$$I \in (WID, tc)$$

Pre-sample share of c-k sale for firm j

Variation in instrument across c-k-t

- Product level instruments capture over-time changes in c's demand for k, trade costs for c-k.

- Firms differ in sale of c-k in pre-sample export bundle

How Large Is the Pain: Idea

Use workers' objective function from bargaining model:

$$W = \max_e \left\{ \beta \frac{\theta_f \psi Y - rK - p_M M}{L} - ac(e) \right\} = \max_e \left\{ C - ac(e) \right\}$$

where C is the workers' income.

Effect of export shock on welfare:

$$\frac{\partial W}{\partial \psi} = C \frac{\partial \ln C}{\partial \psi} - \frac{\partial [ac(e)]}{\partial \psi}$$

Gain Pain

The welfare gain

- For income, C, we use the average wage in our sample
- For $\frac{\partial \ln C}{\partial \psi}$ we use the estimate from HJMX (2014) (elasticity = 0.0493)
- Following a 10% exogenous increase in export, the welfare gain amounts to
  - DKK 1465 for men and DKK 1158 for women

The welfare loss

We assume the cost function, *ac(e)*, relates to injury and sickness rates, d_0,.., d_n, in the following way

$$ac(e) = H(d_0, d_1, ..., d_n) = A d_0^{\beta_0} d_1^{\beta_1} ... d_n^{\beta_n}$$

Then

$$\frac{\partial H}{\partial \psi} = H\left(\beta_0 \frac{\partial \ln d_0}{\partial \psi} + \beta_1 \frac{\partial \ln d_1}{\partial \psi} + ... \beta_n \frac{\partial \ln d_n}{\partial \psi}\right)$$

Total health cost

Weighted sum of the percentage changes of the incidences of individual injury and sickness conditions

The welfare loss

- Use coefficient estimates to get the % changes of the incidences of injury and sickness in response to exports
- For the share weight of injury or sickness conditions (the βs), we use the share of its health-care spending in the total health-care spending in Denmark
- We then obtain total welfare changes in health costs: 1.16% for men and 5.41% for women.