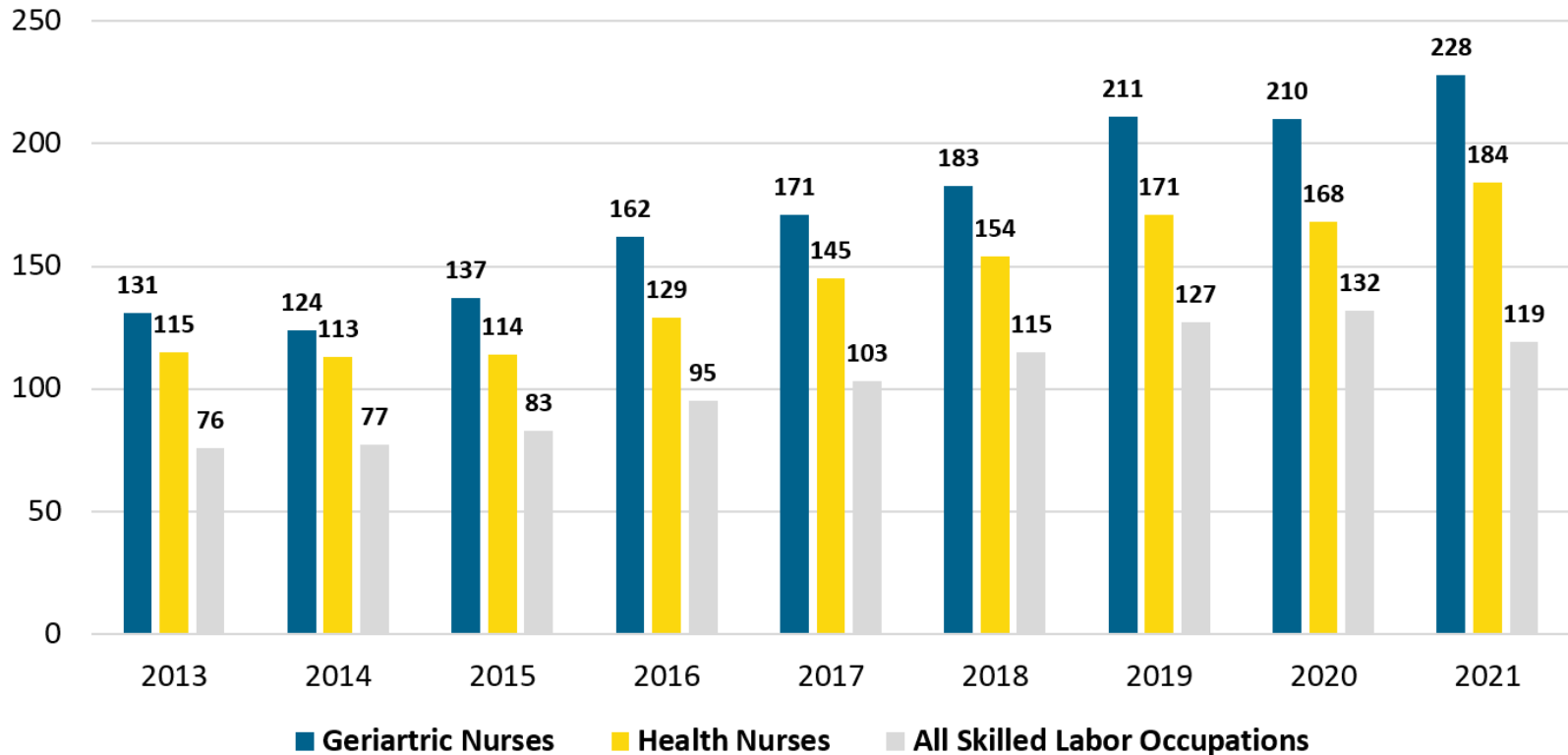# The Reaction of Wages to Skill Shortage in Care Occupations

Andreas Koch, Martin Kroczek
IAW Tübingen
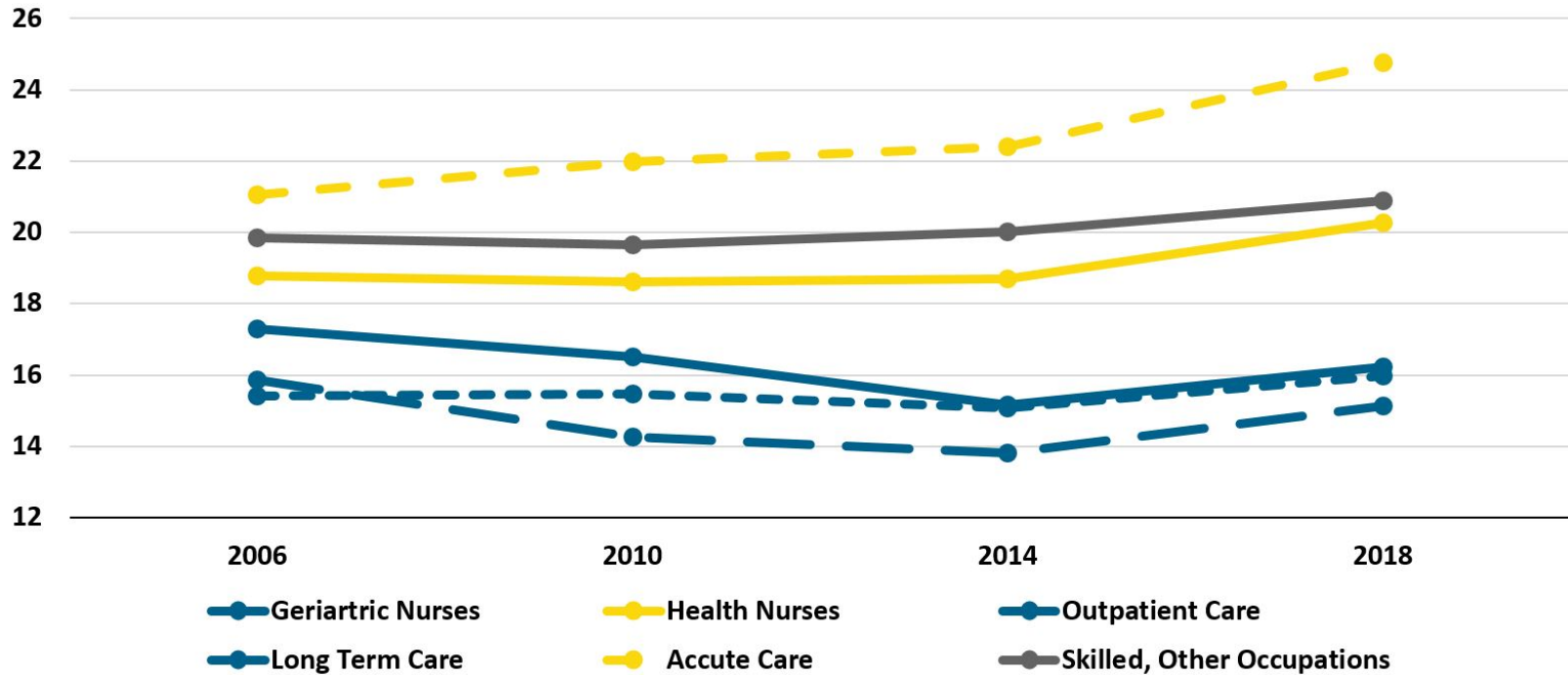
Nutzendenkonferenz "Forschen mit amtlichen Mikrodaten" der FDZ der Statistischen Ämter des Bundes und der Länder 2022
20 October 2022

Rising Skilled Nurse Shortage in Germany...

Average Vacancy in Days - Based on Data From The Federal Employment Agency

Rising Skilled Nurse Shortage in Germany...
...Did Not Coincide With Rising Average Real Wages

Evolution of Gross Hourly Real Wages

Would we expect wages to rise?

To raise labor supply, wages of nurses should rise

- Labor supply effects of wage changes are rather unclear, as results in literature differ (Antonazzo et al., 2003, overview; Shields, 2004, overview; Di Tommaso et al., 2009; Andreassen et al., 2017)
- Positive wage elasticity accounting for *intensive and extensive* margin (Hanel et al., 2014)
- Positive effects on job attractiveness in survey experiments (Doiron et al., 2014; Fields et al., 2018; Kroczek and Späth, 2022)
- Positive effects on job retention and intention to stay (Kankaanranta and Rissanen, 2008; Frijters et al., 2007; Holmås, 2002)
- Positive effects on occupation retention (Kroczek, 2021)

Theory points into the same direction

- Increasing labor shortage $\rightarrow$ higher wages (Mortensen and Pissarides, 1999)

Are nursing wages too strongly restricted to react?

Nurses' wages are restricted, but still show variation

- Central determination of prices for health and care services in a monopsonistic market structure (Simon, 2017; Bogai, 2017)
- Nursing minimum wage $\rightarrow$ small to no effect (Harsch and Verbeek, 2012)
- Nurses in hospitals working mainly under collective agreements
- However: Local and intertemporal wage differences arise
  (Bogai et al., 2015; Jahresgutachten des Sachverständigenrates 2018/2019)

Though constrained, regional wage variation has been identified and analyzed

- Local competitiveness of wages in and outside NHS in UK
  (Elliot et al., 2007; Combes et al., 2018)
- Local competitiveness of wages in public and private sector in France
  (Combes et al., 2015)

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$\Rightarrow$ Are there wage reactions on a more granular level?

Our Paper

Analyzes whether nurse wages rise if nursing labor is scarce
- Exploit local and temporal variation in labor scarcity and wages
- Employ measures of scarcity and proxies for demand for nursing
- Apply IV approach to tackle the simultaneity (wage $\leftrightarrow$ scarcity)

- Hypothesis: Wages should rise if nursing labor is more scarce

Three Months Vac. Positions & Year*ROR Coefficients
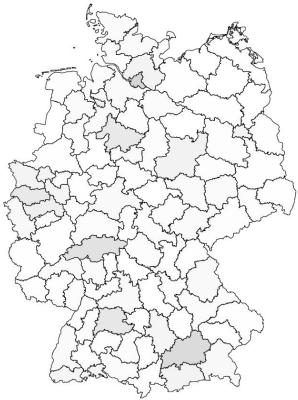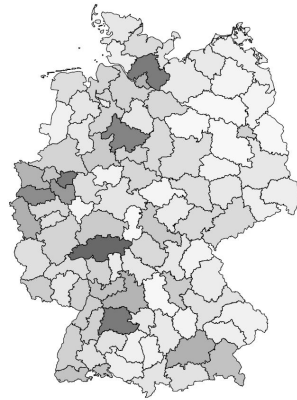
3 Months Vac. 2006   2010   2014   2018
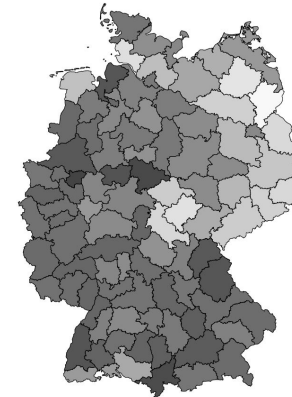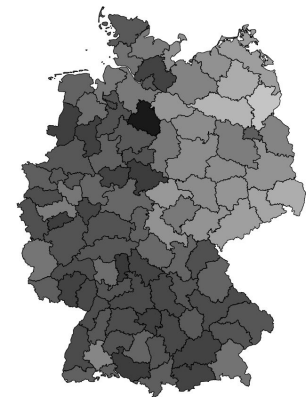
Coefficients 2006   2010   2014   2018

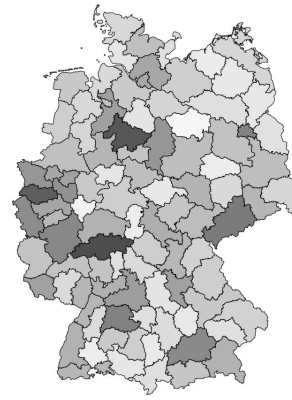# Three Months Vac. Positions & Year*ROR Coefficients
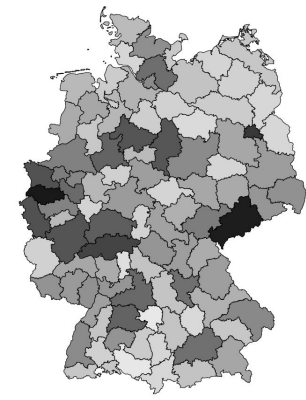

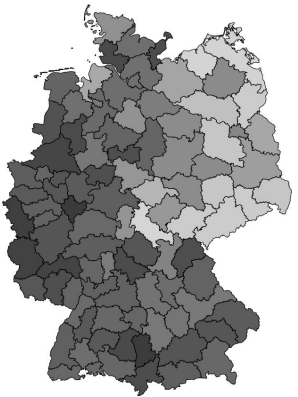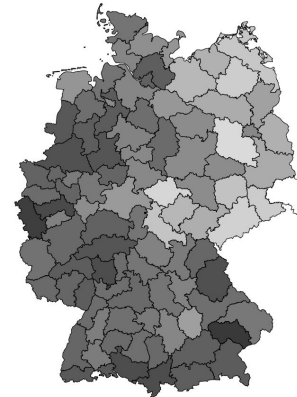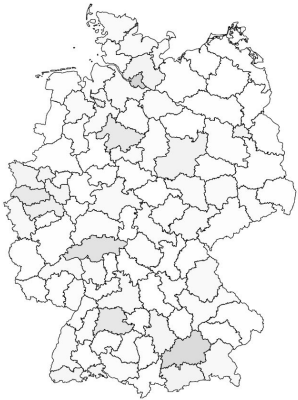3 Months Vac. 2006   2010   2014   2018
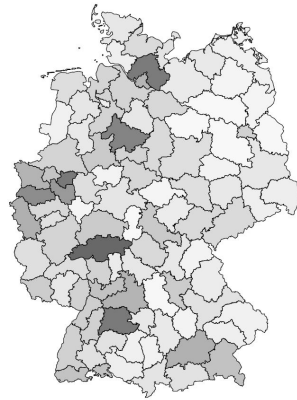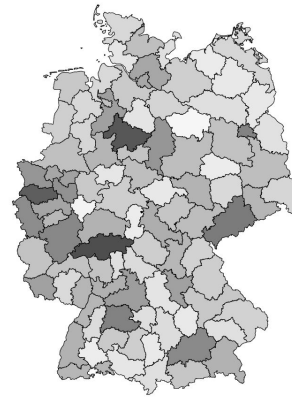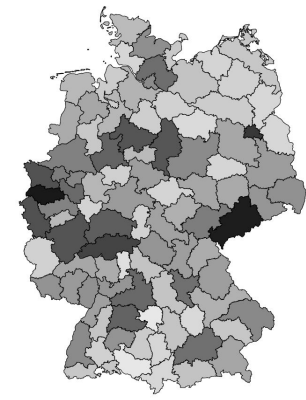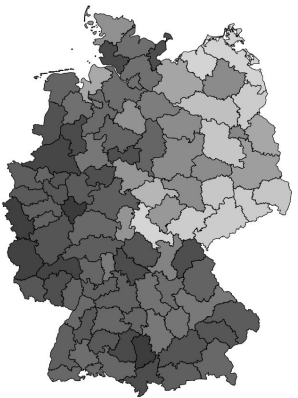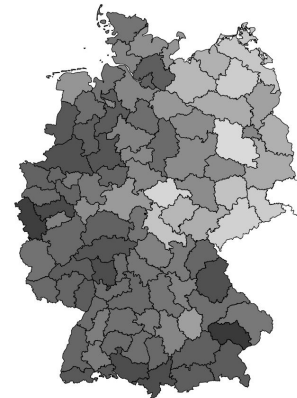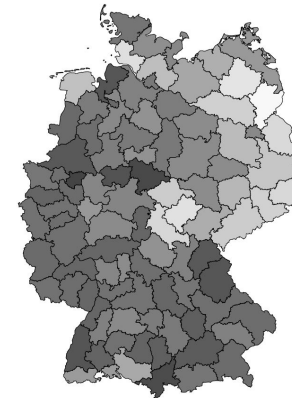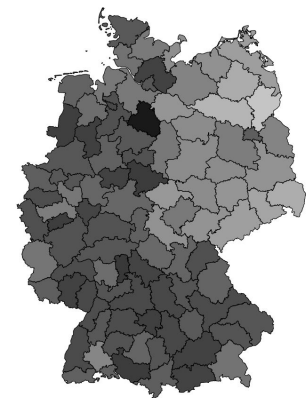
Coefficients 2006   2010   2014   2018

$\Rightarrow$ Considerable local and inter-temporal variation

Data

German Structure of Earnings Surveys (VSE)

- Waves 2006, 2010, 2014, 2018
- ○ Contain information on hourly wages - nurses work part time to a high extent
- ○ Highly reliable as participation of firms is compulsory

Aggregate external data

- INKAR (Federal Institute for Research on Building, Urban Affairs and Spatial Development, BBSR)
- ○ Regionally aggregated data - in our case on level of regional planning regions (*Raumordnungsregionen*)
- ○ Information on economic and social situation, health and many more characteristics

Estimation Strategy

Goal: Estimate causal effect ρ of local labor scarcity s_{jt} on wage Y_{it}
- Fixed effects estimation

$$Y_{it} = \alpha_j + \lambda_t + \rho s_{jt} + X'_{it}\beta + \varepsilon_{it} \tag{1}$$

- ○ α_j: *regional fixed effects*
- ○ λ_t: *time fixed effects*
- ○ s_{jt}: measure of regional scarcity of nursing labor in region j at time t
  - Number of vacant positions
  - Number of positions 3 months vacant
- ○ j: regional planning regions (*Raumordnungsregionen*)

Simultaneity: Reverse effect–scarcity lower where wages higher–should bias ρ downward
- Estimate lower bound
- Proxy demand changes via number of high-aged individuals (75+)

Instrumental Variables Approach

- Instrument s_{jt} with number of high-aged individuals (**z**)
- Apply 2SLS
- **z** must be ...
- ○ strongly correlated with s

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FE Regression Results – Possible Instruments And F-Tests

Geriatric Nurses		
s	**z**	F-Stat.
Number of Vacant Positions	Individuals Older Than 75	29.46
Number of Positions 3 Months Vacant	Individuals Older Than 75	43.68

Health Nurses		
s	**z**	F-Stat.
Number of Vacant positions	Individuals Older Than 75	15.07
Number of Positions 3 Months Vacant	Individuals Older Than 75	28.42

$\Rightarrow$ Rule of thumb: F-Statistic > 10

Instrumental Variables Approach

- Instrument s_{jt} with number of high-aged individuals ($\mathbf{z}$)
- Apply 2SLS
- $\mathbf{z}$ must be ...
- strongly correlated with s
- uncorrelated with ε
- $E[\mathbf{z}'\varepsilon] \neq 0$ if $\mathbf{z}$ and Y correlated via other variables than labor scarcity
- Can neglect such association accounted for by fixed effects
- Factors associated with *changes* in $\mathbf{z}$ and Y
- E.g. migration of elderly people from regions with high nursing wages?

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FE Regression Results Employing Regional Averages

Possible Confounding		
Dependent Variable	Possible Confounder	F-Stat.
Variation in Log Wage, Regional Part	Old Age Migration (65+)	0.16
Variation in Log Wage, Regional Part	Average Age	1.04

Regression Results – Log-Wage, All Nurses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Vacancies (sum)	-0.0000			0.0001		0.0003**		0.0001	
3-month Vacancies (sum)		-0.0000			0.0001		0.0003**		0.0001
Old-Age Pop.			0.0000						
OLS	X	X	X						
2SLS				X	X	X	X	X	X
ROR-FEs & Time FEs	X	X	X	X	X	X	X	X	X
Ownership						Public	Public	Private	Private
R^2	0.46	0.46	0.46	0.46	0.46	0.41	0.42	0.45	0.45
N (unwgt)	81,763	81,763	81,763	81,763	81,763	26,008	26,008	55,755	55,755
First Stages									
Vacancies (sum)				X		X		X	
3-month Vacancies (sum)					X		X		X
Ownership						Public	Public	Private	Private
F-Statistic				17.44	39.40	16.94	44.54	16.42	25.38

Results of 2SLS Regressions – Log-Wage, Hospitals, All Nurses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Vacancies (sum)	0.0001				0.0003**			
3-month Vacancies (sum)		0.0001				0.0003***		
Vacancies (Health N.)			0.0002				0.0006	
3-month Vacancies (Health N.)				0.0001				0.0005**
ROR-FEs & Time FEs	X	X	X	X	X	X	X	X
Ownership					Public	Public	Public	Public
R^2	0.37	0.37	0.37	0.37	0.38	0.39	0.38	0.39
N (unwgt)	55,150	55,150	55,150	55,150	23,999	23,999	23,999	23,999
Vacancies (sum)					0.0003**			
3-month Vacancies (sum)						0.0003***		
Vacancies (Health N.)							0.0006	
3-month Vacancies (Health N.)								0.0005**
ROR-FEs & Time FEs					X	X	X	X
Ownership					Public	Public	Public	Public
Collective Agreement					Yes	Yes	Yes	Yes
R^2					0.38	0.38	0.37	0.38
N (unwgt)					20,279	20,279	20,279	20,279
Vacancies (sum)					0.0001			
3-month Vacancies (sum)						0.0001		
Vacancies (Health N.)							0.0001	
3-month Vacancies (Health N.)								0.0001
ROR-FEs & Time FEs					X	X	X	X
Ownership					Private	Private	Private	Private
R^2					0.38	0.38	0.38	0.38
N (unwgt)					31,151	31,151	31,151	31,151

Results of 2SLS Regressions – Log-Wage, Health Nurses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Vacancies (sum)	0.0001				0.0002**			
3-month Vacancies (sum)		0.0001				0.0002***		
Vacancies (Health N.)			0.0003				0.0005	
3-month Vacancies (Health N.)				0.0003				0.0004**
ROR-FEs & Time FEs	X	X	X	X	X	X	X	X
Ownership					Public	Public	Public	Public
R^2	0.41	0.41	0.41	0.41	0.39	0.39	0.38	0.39
N (unwgt)	72,273	72,273	72,273	72,273	25,042	25,042	25,042	25,042
Vacancies (sum)					0.0003**			
3-month Vacancies (sum)						0.0003***		
Vacancies (Health N.)							0.0006	
3-month Vacancies (Health N.)								0.0004*
ROR-FEs & Time FEs					X	X	X	X
Ownership					Public	Public	Public	Public
Collective Agreement					Yes	Yes	Yes	Yes
R^2					0.37	0.38	0.37	0.38
N (unwgt)					20,818	20,818	20,818	20,279
Vacancies (sum)					0.0002			
3-month Vacancies (sum)						0.0002		
Vacancies (Health N.)							0.0004	
3-month Vacancies (Health N.)								0.0003
ROR-FEs & Time FEs					X	X	X	X
Ownership					Private	Private	Private	Private
R^2					0.41	0.41	0.41	0.41
N (unwgt)					47,231	47,231	47,231	47,231

Results of 2SLS Regressions – Log-Wage, Outpatient Care, All Nurses

Vacancies (sum)	0.0002				0.0003			
3-month Vacancies (sum)		0.0003				0.0003		
Vacancies (Geriatr. N.)			0.0005*				0.0005*	
3-month Vacancies (Geriatr. N.)				0.0006*				0.0007*
ROR-FEs & Time FEs	X	X	X	X	X	X	X	X
Ownership					Private	Private	Private	Private
R^2	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
N (unwgt)	8,313	8,313	8,313	8,313	7,843	7,843	7,843	7,843

Conclusion

Wages seem not to react to nursing shortage on a broad basis

- We find demand-driven effects, but not for all settings
- ○ Possibly due to market frictions (slow adjustment of labor price due to contracts on "higher" levels etc.)
- ○ Possibly due to financial constraints of employers, in private sector, especially

- We find effects for nurses in hospitals and in public sector
- ○ Financial constraints could be lower
- ○ Can costs be passed on to the public budget?

- We find effects for nurses in outpatient care
- ○ Can costs be passed on to recipients more easily?

Thank you!

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