Inter-Industry Spillovers in Labor Productivity and Global Value Chain Impact:

Evidence from Turkey

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1. Introduction

■ BACKGROUND

- The process of international economic integration is rapidly organized around the concept of Global Value Chain (GVC).
- There is no clear verdict on how GVC participation affects productivity.
- Turkey’s participation in to the GVC is rapidly growing and its implication is not well documented.
- The economic theory suggests that sectors are susceptible of significant productivity spillover, however, the channels through which this spillover effects take place remain unclear.

■OBJECTIVE

- To analyze trends in GVCs integration's indicators in Turkey.
- To examine the impact of GVC integration on labor productivity in Turkey.
- To model input-output linkages between industries and empirically examine the productivity spillover across industries (Balassa 1961).
- To investigate whether GVC participation impact on productivity take place both within and across industries

■ THREE RESEARCH QUESTIONS

1. Does GVC integration promote productivity at the industry levels in Turkey?
2. Is the association between GVC participation and productivity confined within own industries solely (direct effects)? Does it transcend across industries as a result of input-output linkages (indirect effects)?
3. Does the input-output linkages stand for a source of productivity spillovers across industries?

☝Past Literature: A few empirical researches exist for Turkey's case. Neither WIOD 2016 nor Spatial Econometric/Statistical model is used.

■ LITTERATURE REVIEW

Main studies:

- Constantinescu et al (2019) studied the impact of the share of foreign value added embodied in export (Backward linkages) on productivity for a sample of 40 countries and 13 manufacturing industries.
- Kummritz (2017) empirically examined the magnitude impact of GVC integration indicators on labor productivity.
- Nasser Dine (2019) used an SLX model to examine the impact of GVC integration on employment generation in Turkey.
- Badinger and Egger (2008), used spatial econometric approach to model the total factor productivity spillovers at the R&D industry level and a reminder spillover not related to knowledge spillovers, which they modelled using an autoregressive error model

■ THREE HIGHLIGHTS and CONTRIBUTIONS

1. This study uses the WIOD 2016 and examine the impact of GVC integration on productivity in Turkey.
2. In contrast of the existing literature, this study accounts for interdependencies between industries to examine the impact of GVC participation on productivity.
3. The study makes use of the modeled interdependencies to examine the Balassa 1961 hypothesis, which states that linkages between industries are key source of productivity spillovers and transmission of technological improvements.
4. The study is deemed the first to deploy spatial weight matrix and spatial econometrics approach to capture the interdependencies between industries and to empirically examine productivity across industries.

■ MAIN RESULTS

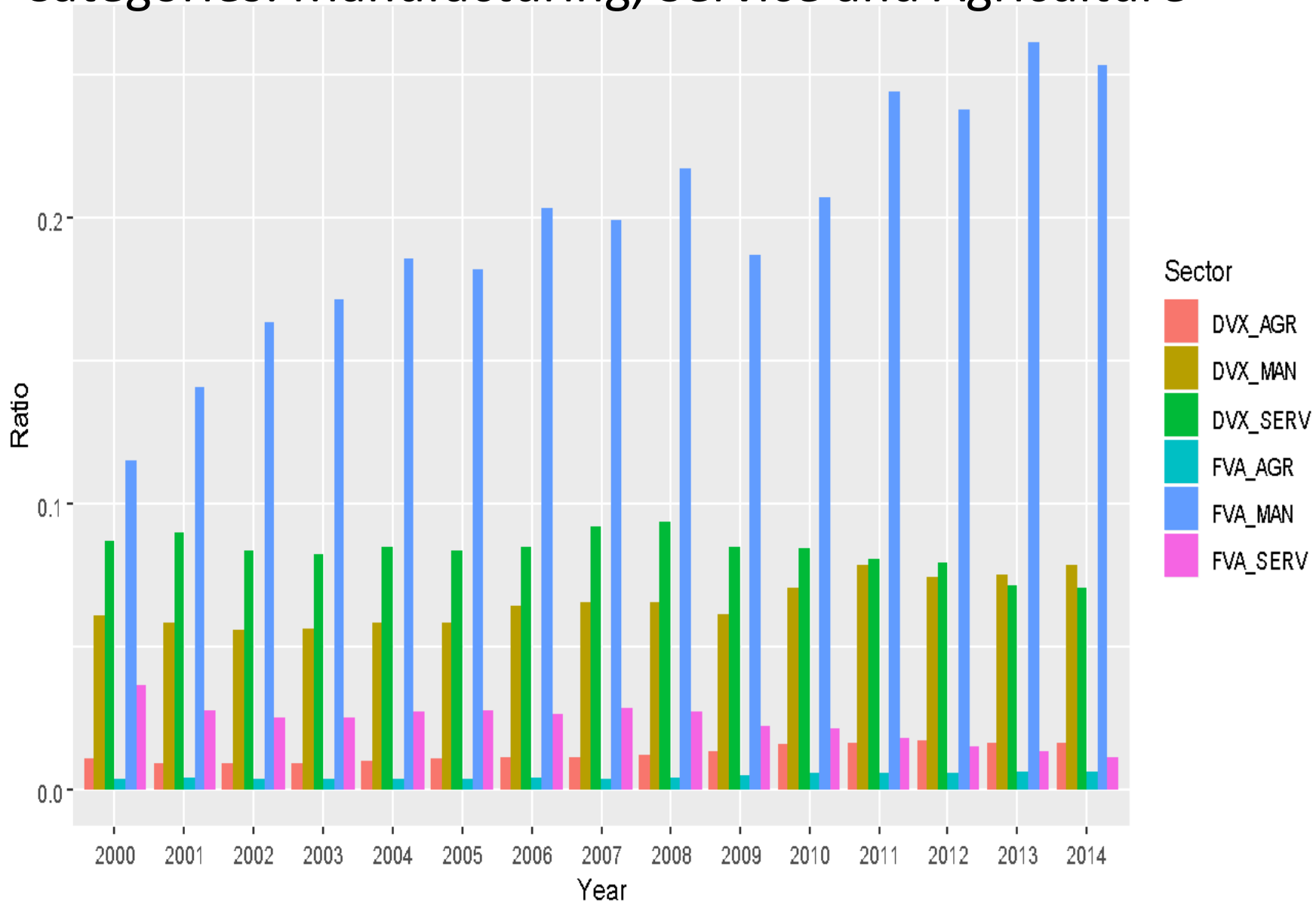
1. Productivity in manufacturing industries significantly declines with backward linkages not only within own industries but also across manufacturing industries.
2. Productivity in service industries significantly rises with forward linkages both within and across service industries.
3. There is a significant positive diffusion of labor productivity across industries through the input-output relations.

☝ + We also report a positive association between the stock of capital and productivity.

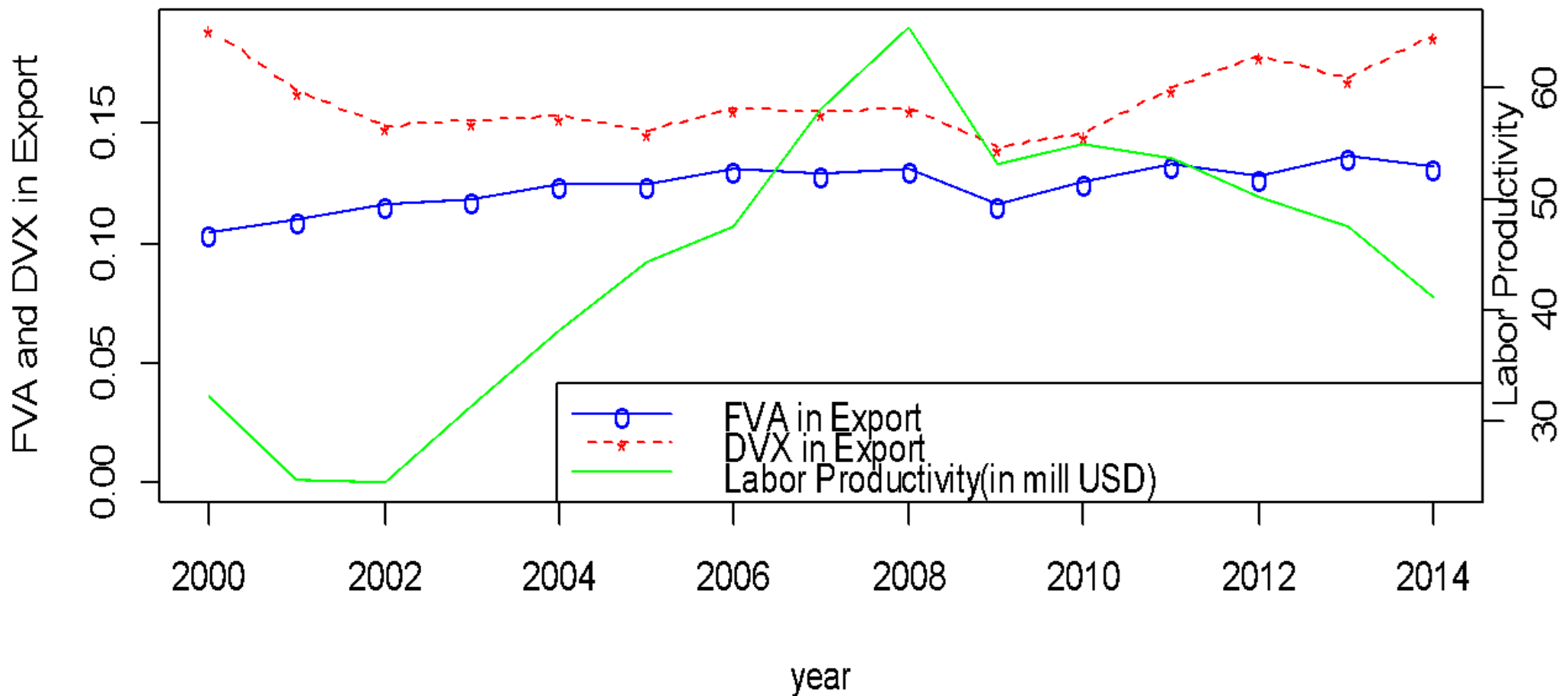
2. Data

- International input-output for 43 countries, 56 sectors and from 2000-2014.
- Extract the backward and forward linkages using Leontief 1936's method.
- Backward linkages : The foreign value added as a share for gross export (Import of intermediates used in country's export)
- Forward linkages : The indirect value added as share of gross export (export of intermediates used in third countries' export).

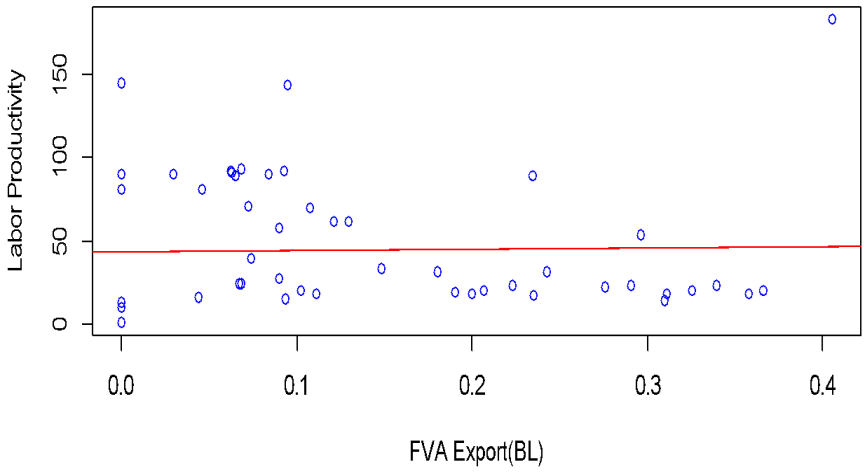
Sector-Average backward (FVA) & Forward (DVX) linkages by Categories: Manufacturing, Service and Agriculture

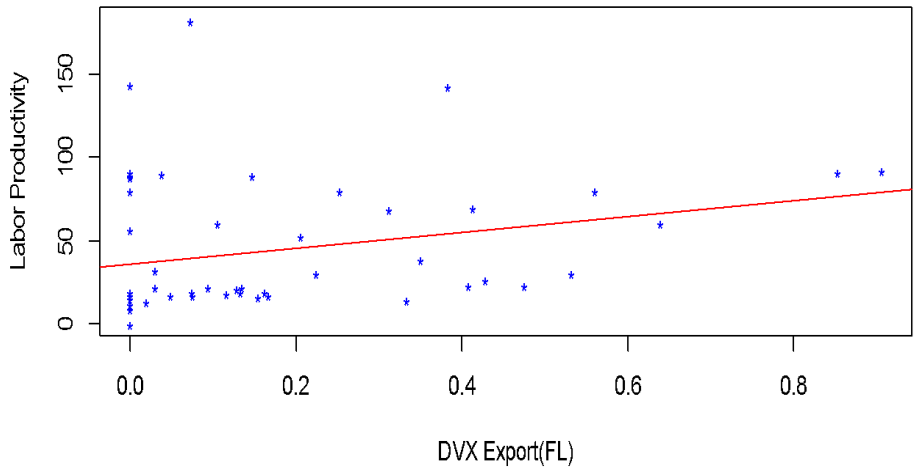


Sector-Average of Backward, Forward and Labor productivity 2000~2014



Scatterplots of FVA, DVX Export and Labor Productivity





The Input—output Weight Matrix

Weight Matrix	Normalization	Dimension	% nonzero weights	Av No of Links	Symmetry
Input-Output Weight Matrix	Row-Standardized	56 × 56	64.63	36.19	No symmetrical

3. ESTIMATION MODEL

■ NON-SPATIAL MODEL:

- A Cobb-Douglass specification of the production functions;

$$log(P_{it}) = a + \mu_1 log(BL_{it-1}) + \mu_2 log(FL_{it-1}) + \alpha log(K_{it-1}) + \beta log(W_{it-1}) + \varphi_i + \tau_t + \epsilon_{it}$$

■ SPATIAL MODELS:

- SAR model

$$log(P) = a + \rho W log(P) + \mu_1 log(BL) + \mu_2 log(FL) + \alpha log(K) + \beta log(W) + \varphi + \tau + \epsilon$$

- SEM model

$$log(P) = a + \mu_1 log(BL) + \mu_2 log(FL) + \alpha log(K) + \beta log(W) + \varphi + \tau + \epsilon$$
$$\epsilon = \lambda W \epsilon + \varepsilon \quad and \quad \varepsilon \sim N(0, \sigma^2 I)$$

☝ SAR and SEM stand for spatial Autoregressive model and spatial error model respectively.

■ MORAN *I* TEST FOR NON-SPATIAL MODEL:

- The Moran I test for spatial autocorrelation is run on the residual of the Non-spatial model.
- A Monte Carlo randomization technique is used to generate the distribution.

Monte-Carlo simulation of Moran's I statistics

several significant Moran's I tests are reported, which suggests that non-spatial model suffers from interdependence in the error terms.

p-value	Statistic	Year	p-value	Statistic	Year
0.008991	0.099086	2001	0.023976	0.086131	2008
0.007992	0.142183	2002	0.421578	-0.00559	2009
0.976024	-0.112	2003	0.292707	0.007934	2010
0.92008	-0.08219	2004	0.140859	0.039491	2011
0.824176	-0.05465	2005	0.466533	-0.01334	2012
0.347652	0.005042	2006	0.625375	-0.03138	2013
0.01998	0.086741	2007	0.285714	0.011301	2014

	Dependent Variable: Log of productivity			
	Models without Spillovers		Models with Spillovers	
Variables	OLS	Two-way FE	SAR	SEM
FVA	-0.29***	-0.087	-0.08*	-0.12**
	(0.031)	(0.053)	(0.047)	(0.05)
DVX	0. 10***	0.056**	0.062***	0.072***
	(0.03)	(0.026)	(0.023)	(0.022)
K	0.62***	0.47***	0.41***	0.44***
	(0.018)	(0.022)	(0.021)	(0.021)
W	0.026*	0.16***	0.06**	0.12***
	(0.014)	(0.026)	(0.026)	(0.03)
Rho/Lambda			0.35***	0.77***
			(0.039)	(0.034)
R-squared	0.81	0.5	0.246	0.227
Time FE	No	YES	YES	YES
Sect FE	No	YES	YES	YES
LM test (Honda)	64.99***			
LM test for Lag dep	196.57***	10.15***		
LM test for error dep	43.65***	6.6**		
LL			517.5	498.24
AIC			-885	-846.49
BIC			-535.16	-496.66

Point estimates

"spatial" parameters

Fixed effects hypothesis

inclusion either diffusion in the dependent variable or error term

Goodness of fit statistics suggest that SAR model is preferred.

Monte Carlo simulation of :

- Direct effects: Average within own industries effects.
- Indirect effects: Average of across industries effects
- Total effects: sum of the direct and indirect effects.

Variables	Direct	Indirect	Total
FVA	-0.081*	-0.043	-0.12*
	(0.047)	(0.026)	(0.073)
DVX	0.062***	0.033***	0.095***
	(0.024)	(0.014)	(0.037)
K	0.41	0.22	0.63
	(0.021)	(0.036)	(0.040)
W	0.06***	0.032***	0.092***
	(0.026)	(0.013)	(0.038)

- 10% increase in backward linkages lead productivity to decline by 0.81%. (Substitute hypothesis).
- 10% increase in forward linkages lead productivity to rise by 0.62% within own sector and 0.3% across sectors. (Concept of learning by exporting (De Loecker 2013).
- A positive and significant diffusion of productivity across industries. (Balassa 1961's hypothesis is verified through input-output relations)

■ A SECTORAL ANALYSIS:

- GVC’s Participation impact varies among different sectors.
- The distribution of the value added is U-shaped (Baldwin 2012).
- Different production and services technologies (Banga 2018).
- Labor skill distribution varies among sectors.

- Productivity declines with backward linkages within and across industries.
- Productivity declines with forward linkages within own industries.

Variables	Manufacturing			Service	
	Fixed Effects	SAR		SAR	
		Direct Effects	Indirect Effects	Direct Effects	Indirect Effects
FVA	-0.32***	-0.36***	-0.355***	0.02	0.004
	-0.078	-0.071	-0.12	-0.068	-0.017
DVX	-0.082*	-0.065*	-0.064	0.10***	0.026***
	-0.043	-0.038	-0.043	-0.029	-0.01
LgK	0.36***	0.32***	0.32***	0.58***	0.14***
	-0.039	-0.035	-0.09	-0.029	-0.038
LgW	0.23***	-0.032	-0.031	0.033	0.008
	-0.065	-0.066	-0.074	-0.028	-0.0067
Rho		0.51***		0.20***	
		-0.063		-0.045	
LL		251.83		311.17	
AIC		-427.66		-518.35	
BIC		-291.48		-303.3	

- Productivity rises with forward linkages within and across industries.

- The diffusion of productivity across industries is positive, significant.
- the productivity's diffusion is more pronounced for manufacturing industries

4. Concluding Remarks

- This study examines the impact of GVCs participation on labor productivity using the WIOD 2016.
- The study accounts for across industries diffusion in productivity through the input-output linkages.

The study reveals that:

- The impact of GVCs participation indicators on productivity are not confined within own industries only but transcend to other industries via the input-output relations.
- Particularly, productivity declines with backward linkages both within and across manufacturing industries.
- Productivity rises with forward linkages within and across service industries.
- A significant diffusion across manufacturing and service industries is reported and it's more pronounced for manufacturing industries.

Further direction of research:

- An interesting direction of research is the to extend study to account for the diffusion in productivity across industries through the input-output relations for all countries in the WIOD 2016.

THANK YOU