Factor Misallocation, Entry and Exit, and Agricultural Productivity in Ukraine

Klaus Deininger
World Bank

Denys Nizalov
University of Kent/Kyiv School of Economics

Mykola Ryzhenkov
Kyiv School of Economics

Sudhir K Singh
World Bank

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Introduction

- One of the central topics in modern development economics is resource misallocation in various sectors of economy and its impact on productivity.
- Misallocation accounts for major portion of differences in income and productivity across countries.
- There is little known about resource misallocation in agriculture and its impact on agricultural productivity due to lack of quality data in the sector.
- Ukraine provides a unique institutional setting as compared to other European countries.
- It is one of the few countries where farm size are relatively large and that have seen rapid expansion of large farms over the last decade.
- Since December 2001 sales and conversion of over 96% of agricultural land in Ukraine are banned by the Moratorium.

Literature

- Restuccia and Rogerson (2008) and Hsieh and Klenow (2009): idiosyncratic distortions affect allocation of resources across establishments and total factor productivity.
- A huge number of studies of manufacturing. Some examples, Hsieh and Klenow (2009) – China, India, USA; Oberfield (2013) and Chen and Irarrazabal (2015) – Chile; Bellone and Mallen-Pisano (2013) – France; Dias et al. (2016) – Portugal; Ryzhenkov (2016) – Ukraine
- In opposite to manufacturing, a few studies exist on the impact of resource misallocation on productivity in agriculture.
- Adamopoulos and Restuccia (2014) – agriculture in poorer countries is less productive than nonagriculture when compared to rich countries, a larger fraction of allocated to agriculture than in rich countries.
- Restuccia and Santaeulalia-Llopis (2017) - agriculture is important in accounting for productivity differences between poor and rich counties, a bulk of productivity losses due to factor misallocation are directly associated with restricted land markets

Literature

- Gollin et al. (2014) explain cross-country differences in agricultural productivity with three hypotheses:
  - policy-driven land misallocation
  - farmers in poor countries do not use productivity-enhancing inputs
  - agriculture in poor countries employ the lowest-ability labor.

- Results on agriculture:
  - Restuccia and Santaeulalia-Llopis (2017) – 3.6 fold gains for Malawi
  - Adamopoulous et al. (2017) - 84% gains for China.
  - Dias et al. (2016) - 17.0-31.3% for Portugal

- Results on Ukraine in manufacturing sector:
  - Ryzhenkov (2016) - 146-249% for Ukrainian manufacturing

Methodology

- Accounting framework follow Hsieh and Klenow (2009) and Dias et al (2016)
  - Assume an economy with single final good Y produced by M number of heterogeneous agents i.e. farms using Cobb-Douglas technology

$$Y_i = A_i L_i^{\theta_l} K_i^{\theta_k} H_i^{\theta_h}$$

  - Where Y_i is the output produced by farm *i*.
  - A_i is the TFP across farms.
  - Higher misallocation can generated higher dispersion in A_i across farms.
  - Specific policy such as size dependent tax/subsidies policy can generate misallocation that can affect TFP (Restuccia et al 2008)
  - Aggregate agricultural output is a CES aggregate of differentiated products produced by farms
  - Each farm faces three types of distortions estimated as implicit input/output wedges/taxes
  - Three types of distortions include land, capital, and output wedges

Data

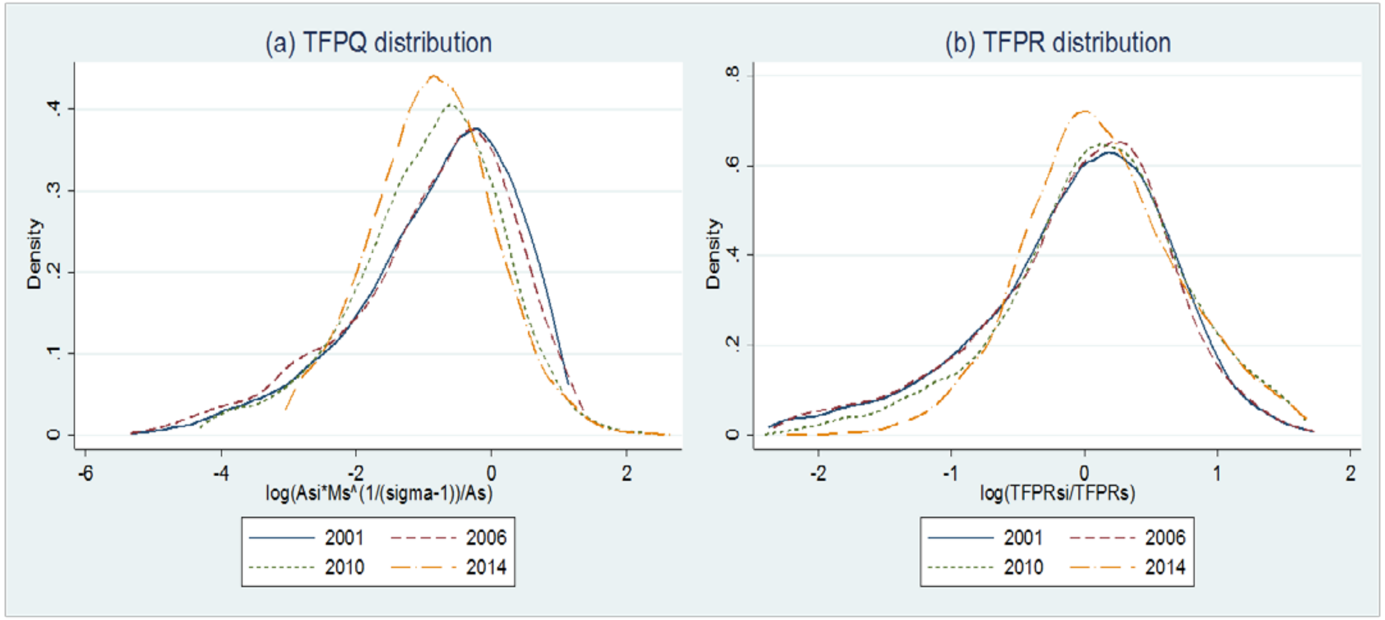
- Source:
  - Very rich panel data on commercial farm from Ukraine collected by Ukraine's State Statistics Committee
  - Statistical form 50-SG "Report on main economic indicators of performance of agricultural enterprises"
- Construction of a database:
  - The universe of the about 10,000 large commercial farms in the country
  - These farms cultivate about 89 percent of commercially farmed land
  - Sample is restricted to crop producers with physical output valued at median prices for each rayon
  - Farms above 200 ha are required to report
  - Wage bill and physical units of a labor is reported in the data
  - Dataset also contains arable area and rental payments for land
  - Physical output is reported by crops and farm, monetary value of sales and quantity sold are also reported
  - Value added is calculated in a standard way by subtracting the intermediate inputs from output values
- Some challenges in data:
  - A commercial farm can operate on multiple parcels known as branches.
  - No information on capital stock in the data, we have information on capital depreciation for each farm by years

Data

	All	Median	10th Percentile	90th Percentile
TFP	1.975	1.454	0.04	7.127
Total output ('0000')	812.8	929.77	319.19	1061.13
Output per ha	3343.26	3408.71	1391.66	6403.58
Land	2157.02	2310.5	1878.19	1691.03
Median land	1480	1651	1140	1181.5
Max. land	2829.09	2966.21	2600.9	2417.59
Share of leased land	0.8	0.81	0.72	0.88
Profit per ha	443.37	515.32	-1944.98	2870.4
Cost per ha	2900	2893.39	3336.52	3533.18
Capital per ha	362.22	381.15	451.38	332.58
Labor per ha	383.24	381.96	455.92	408.75
Intermediate Inputs per ha	2581.7	2481.76	3064.45	3628.47
Wage rate per day	6.36	6.64	6.11	4.7
Cost of leasing per ha	486.44	500.38	383.42	656.35
Share of input cost				
Leased value	19.11	18.91	14.67	23.04
Labor	14.08	14.55	13.85	9.94
Capital	11.63	12.62	10.81	7.67
Seed	14.15	13.56	17.12	14.07
Fuel and electricity	18.56	18.99	19	15.23
Fertilizer	11.74	11.91	11.29	13.11
Oher inputs	10.76	9.45	13.38	16.85

Dispersion of productivity and wedges

Distribution of TFPQ and TFPR



TFPQ distribution:

- Skewed to the left, i.e. indicating that more farms are less productive than the average productivity in agriculture.
- The granularity in productivity increases over time, as more farms become less productive than the average TFPQ, while the average increase.

TFPR:

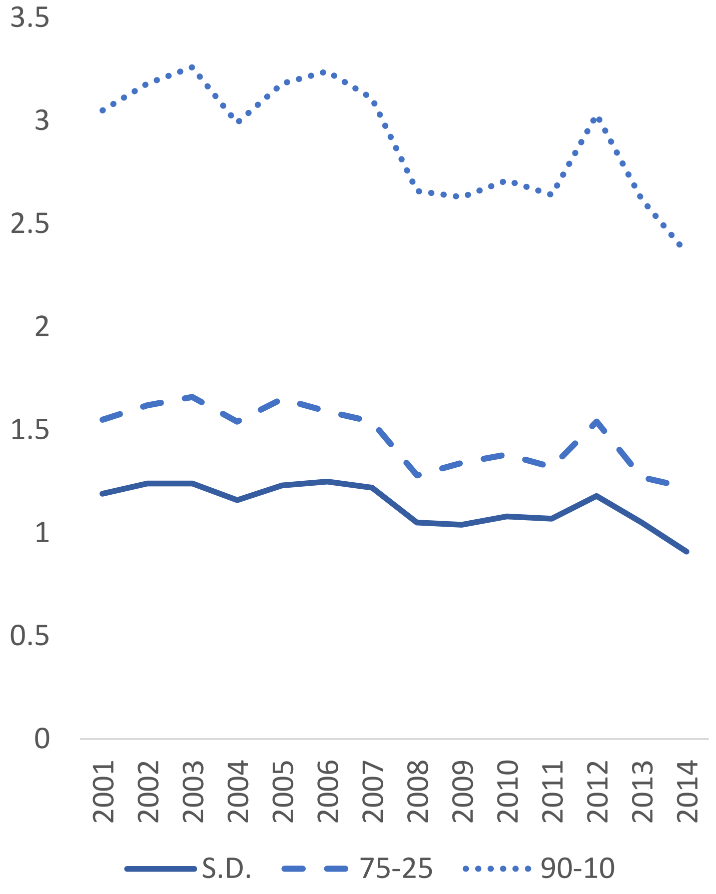
- Variation indicates the presence of misallocation

Wedges:

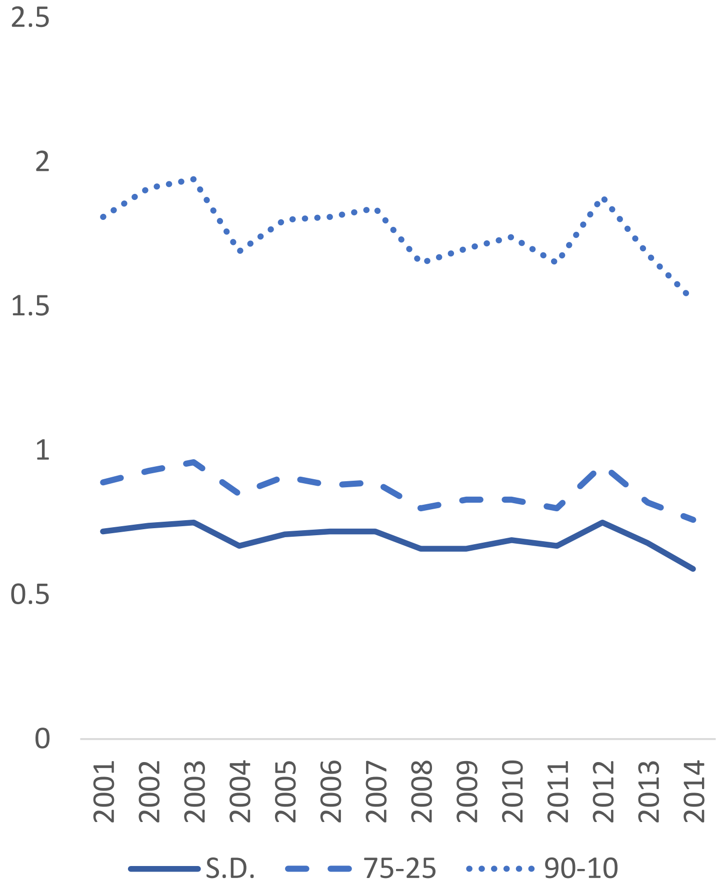
- Land wedge has the highest dispersion

Dispersion of productivity and wedges

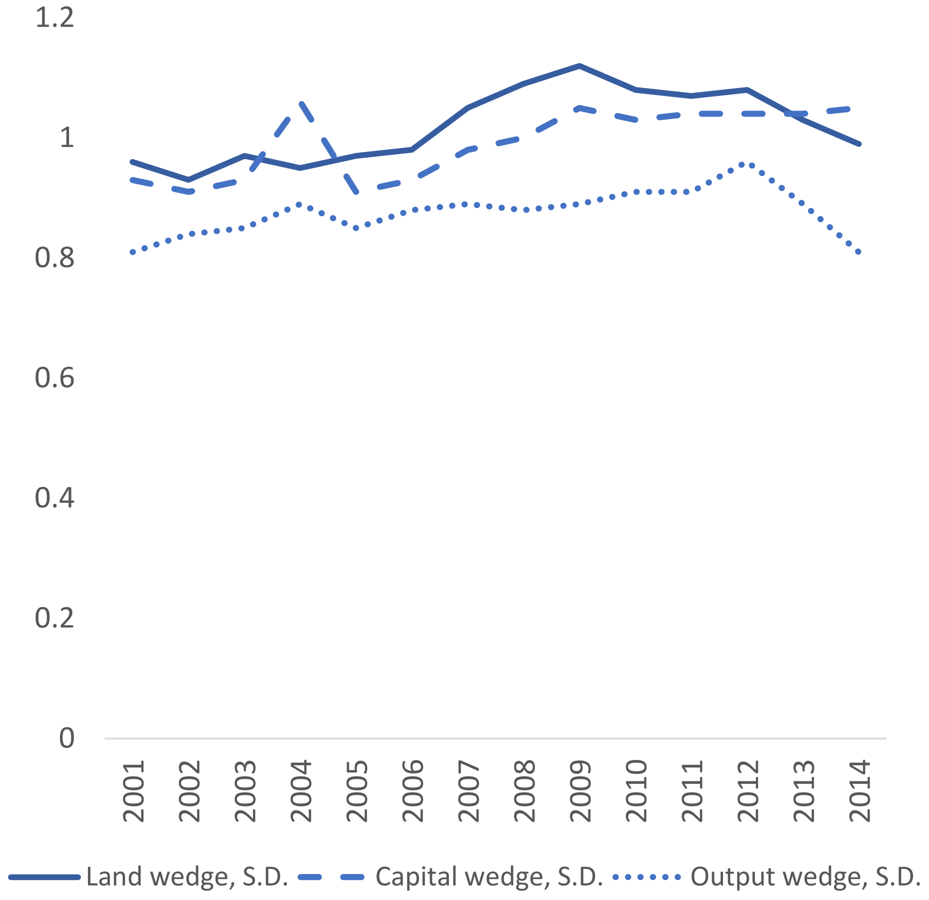
Physical productivity, TFPQ



Revenue productivity, TFPR

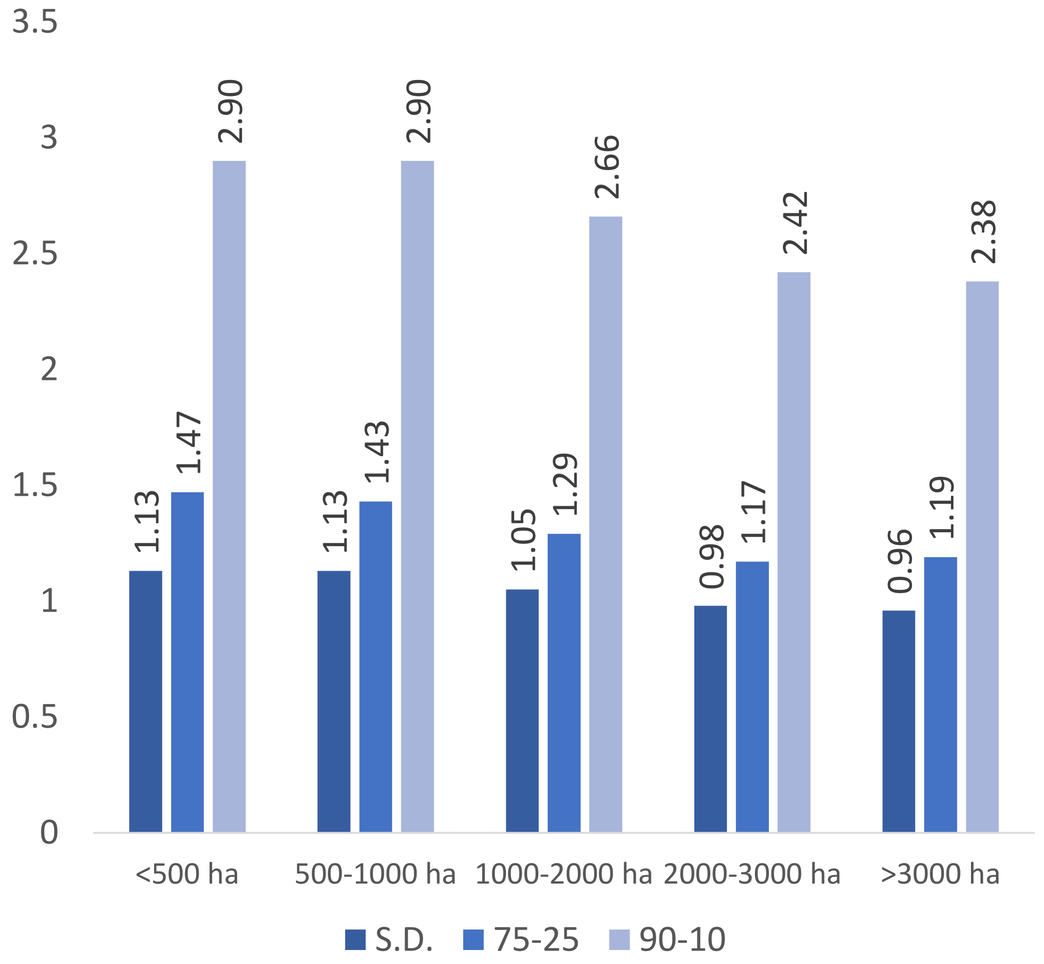


Wedges

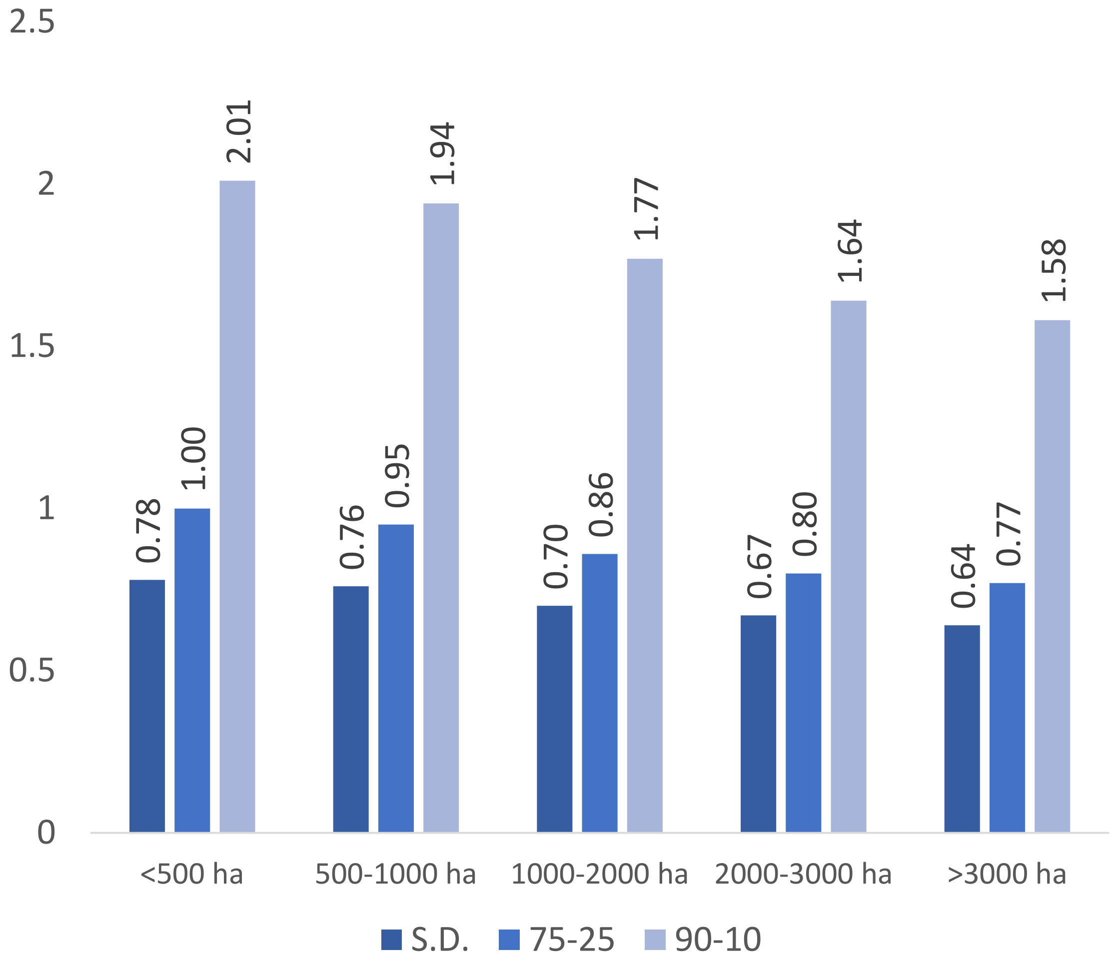


Dispersion of productivity by farm size

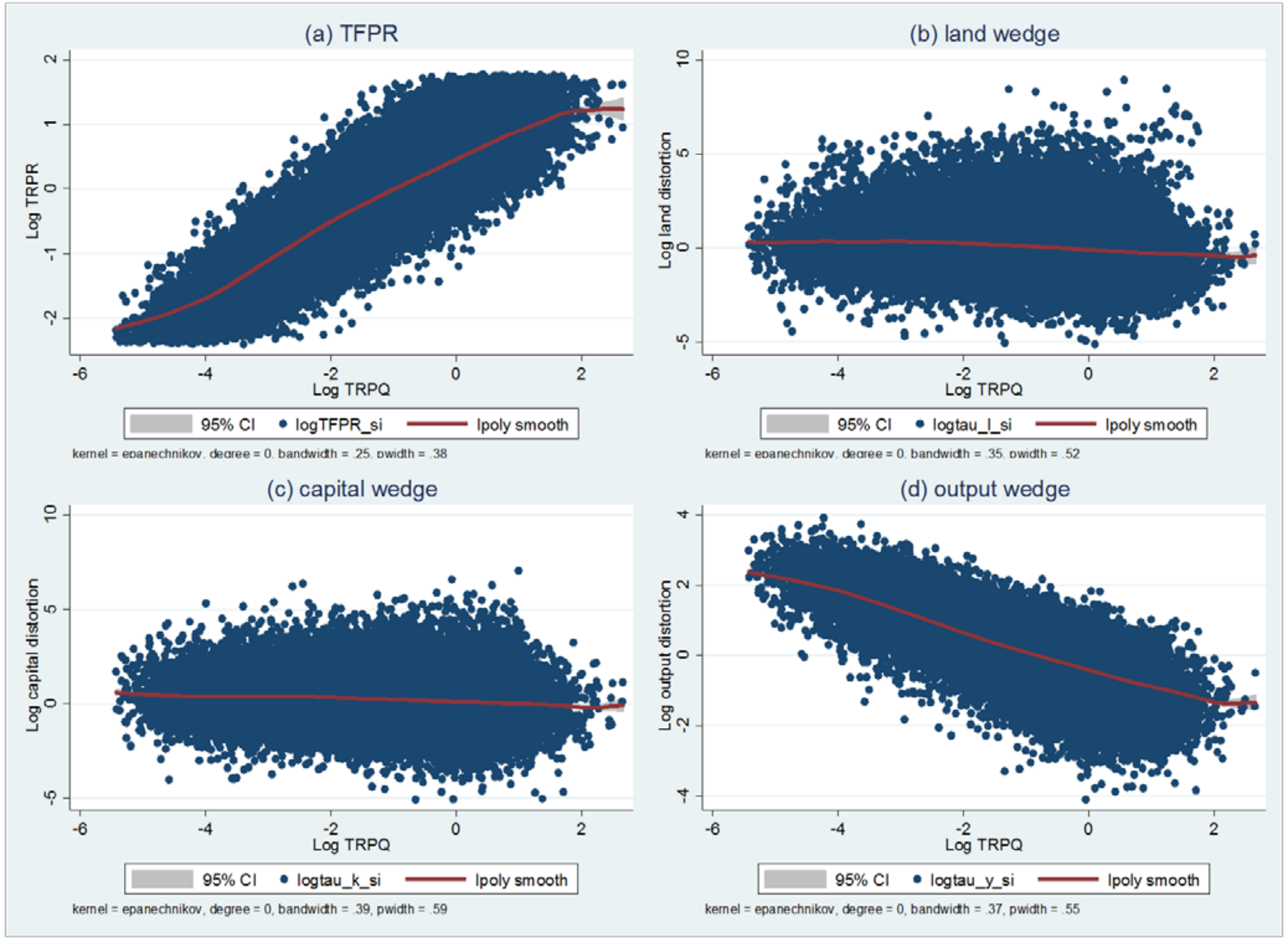
Physical productivity, TFPQ



Revenue productivity, TFPR



Distortions vs. productivity



- A strong positive correlation between physical productivity TFPQ and revenue productivity TFPR (correlation 0.86).
- The farms do not adjust their prices depending on productivity to equalize TFPR.
- Land and capital wedge have a negative weak correlation with productivity of a farm (-0.18 and -0.12, respectively)
- Strong negative correlation between output wedge and farm's productivity (-0.77).
- Current policies in agriculture mainly subsidize the least productive farms and tax the most productive ones.

Productivity gains from efficient allocation

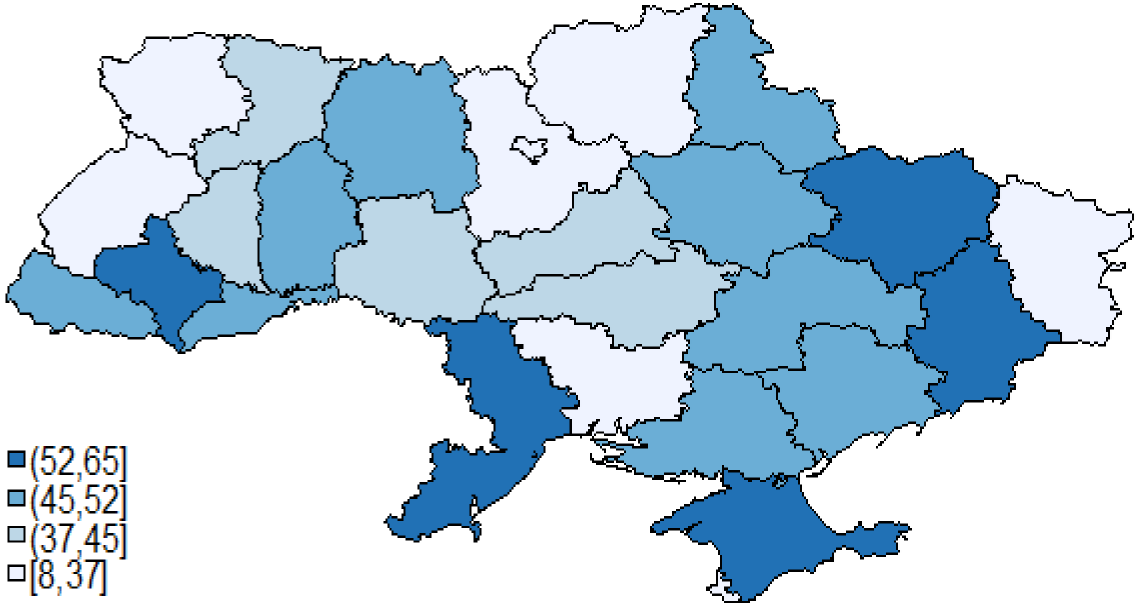
Productivity gains due to efficient allocation of resources

Year	TFP gains from efficient allocation, %		
	Full	*Within farm size*	*Within oblasts*
2001	59.5	51.3	46.8
2002	61.0	51.1	47.1
2003	64.9	46.4	41.6
2004	55.0	36.2	33.3
2005	56.0	35.9	36.2
2006	60.1	41.9	27.7
2007	77.4	54.8	36.8
2008	83.5	63.7	47.7
2009	90.0	76.0	51.9
2010	82.7	70.6	47.0
2011	76.6	49.0	49.4
2012	90.2	59.5	57.9
2013	79.6	70.1	44.3
2014	80.6	63.5	51.5
Average	71.9	55.0	44.2

Productivity gains by farm size group, average in 2001-2014, %

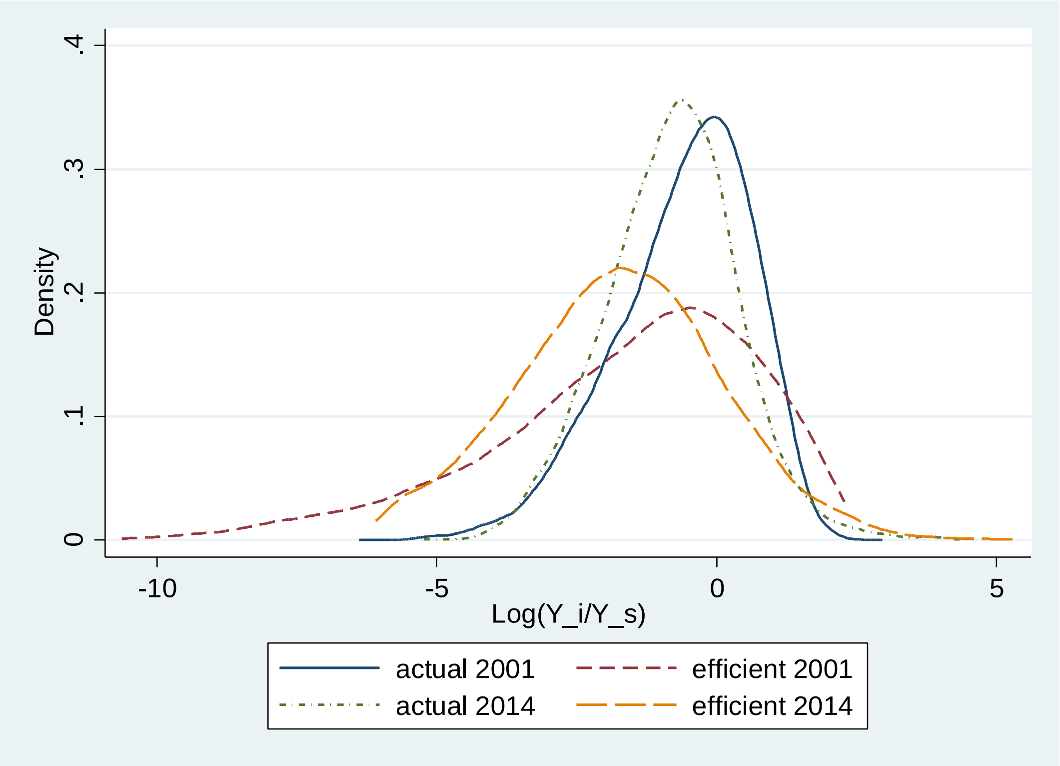
Year	TFP gain within a farm size group, %				
	<500	**500-1000**	**1000-2000**	**2000-3000**	**>3000**
Average in 2001-2014	73.30	65.92	60.49	55.41	50.55

Productivity gains by oblast, average in 2001-2014, %



Actual vs efficient production

Actual vs. efficient distribution of production, %



- Efficient allocation tends to have wider left tail and higher dispersion
- In the efficient allocation most of the farm should be downsized, i.e. the role of small farms in the aggregate agricultural value added should be higher

Efficient vs actual farm size (by land area), % of total farms

2001	*0-50*	*50-100*	*100-200*	*>200*
<500 ha	5.1%	1.4%	0.9%	0.8%
500-1000 ha	11.2%	3.3%	2.1%	1.7%
1000-2000 ha	20.5%	6.6%	4.9%	3.1%
2000-3000 ha	10.0%	4.7%	3.3%	1.8%
>3000 ha	8.2%	5.1%	4.1%	1.2%
# of firms	5256	2019	1462	822
Share of firms	55.0%	21.1%	15.3%	8.6%
2014	*0-50*	*50-100*	*100-200*	*>200*
<500 ha	7.5%	2.6%	2.0%	1.9%
500-1000 ha	9.3%	3.0%	2.2%	2.2%
1000-2000 ha	18.9%	6.3%	3.2%	2.8%
2000-3000 ha	10.7%	3.0%	1.9%	1.0%
>3000 ha	13.8%	3.7%	2.2%	1.9%
# of firms	3570	1097	678	584
Share of firms	60.2%	18.5%	11.4%	9.8%

Robustness checks

Robustness checks, average in 2001-2014, % gains

Scenario	Sigma	Trim	Shares	Full	Within farm size	Within oblasts
Baseline	5	2%	US	71.9	55	44.2
Alternative 1	3	2%	US	111.2	94.7	85.2
Alternative 2	3	1%	US	86.9	77	64.1
Alternative 3	3	5%	US	54.5	23.3	13.7
Alternative 4	3	2%	Ukraine	68	50.7	39.2
Alternative 5	3	2%	China	66.2	48.4	37.8

- Higher sigma raise gains of full liberalization. This implies that we can consider our baseline results as the conservative ones.
- Trimming 2% tails of outliers allows getting more consistent results as compared to trimming 1%, but less optimistic than trimming 5%.
- The US factor shares used in the baseline calibration generate the highest gains as compared to the Ukrainian or Chinese factor shares.

Productivity and selection

Entry/exit versus productivity and factor wedges

	(1) TFPQ	(2) TFPR	(3) $1+\tau_l$	(4) $1+\tau_k$	(5) $1-\tau_y$
Entrant	-0.063^{***}	0.003	-0.035^{**}	0.098^{***}	0.026^{*}
	(0.014)	(0.010)	(0.012)	(0.012)	(0.011)
Exiter	-0.122^{***}	-0.005	-0.074^{***}	0.070^{***}	0.017
	(0.014)	(0.010)	(0.011)	(0.012)	(0.011)
Log land	0.379^{***}	-0.022^{**}	-0.135^{***}	-0.137^{***}	-0.051^{***}
	(0.011)	(0.008)	(0.010)	(0.010)	(0.009)
Age	-0.055^{***}	-0.015^{***}	0.018^{***}	0.032^{***}	0.030^{***}
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Intercept	-3.468^{***}	0.245	0.994^{***}	1.433^{***}	0.450^{**}
	(0.211)	(0.148)	(0.176)	(0.178)	(0.168)
Year FE	Yes	Yes	Yes	Yes	Yes
Oblast FE	Yes	Yes	Yes	Yes	Yes
N	80662	80662	80662	80662	80662
R^2	0.096	0.012	0.012	0.032	0.024

Note: Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All the models are evaluated with fixed effects regressions. Dependent variables are logs of productivity/wedge measure divided by the industry mean. The estimated model is

- Exiters are found to be the least productive, while incumbents are the most productive.
- Increase in arable area by 1% results in 0.37% of physical productivity, while additional year of operation on average leads to 5.4% lower TFPQ.
- No statistically significant difference in TFPR among exiters, entrants and incumbents.
- Entrants face lower land wedge, higher capital wedge and higher output wedge, as compared to the incumbents
- Exiters face lower land wedge and higher capital wedge, as compared to incumbents, but no significant difference in output distortion.

Conclusions

- Liberalization of the land market in addition to deregulation will improve the allocation of resources in agriculture, which will lead to higher productivity in agriculture.
- We apply Dias et al (2016), which is extended version of Hsieh and Klenow (2009), to a rich panel data of Ukrainian commercial farms.
- We found a high and persistent variation of revenue productivity indicating the presence of resource misallocation. A land wedge is found to have the highest variation.
- Fully optimal allocation of resources, on average, can boost agricultural productivity by 71.9%. Optimal allocation within farm size groups can increase productivity by 55.0%, while eliminating distortions within oblasts can add 44.2% to current agricultural productivity.
- Small farms are more distorted than the big ones.
- We do not found clear patterns in a spatial distribution of productivity gains.
- In an optimal distribution more small-size farmers should operate in Ukrainian agriculture.
- We also found that entry and exit of farms in Ukrainian agriculture lead to positive selection in favor of more productive farms.

Thank you!