

Agricultural Productivity and Resilience to External Shocks: an empirical study of selected CAREC countries

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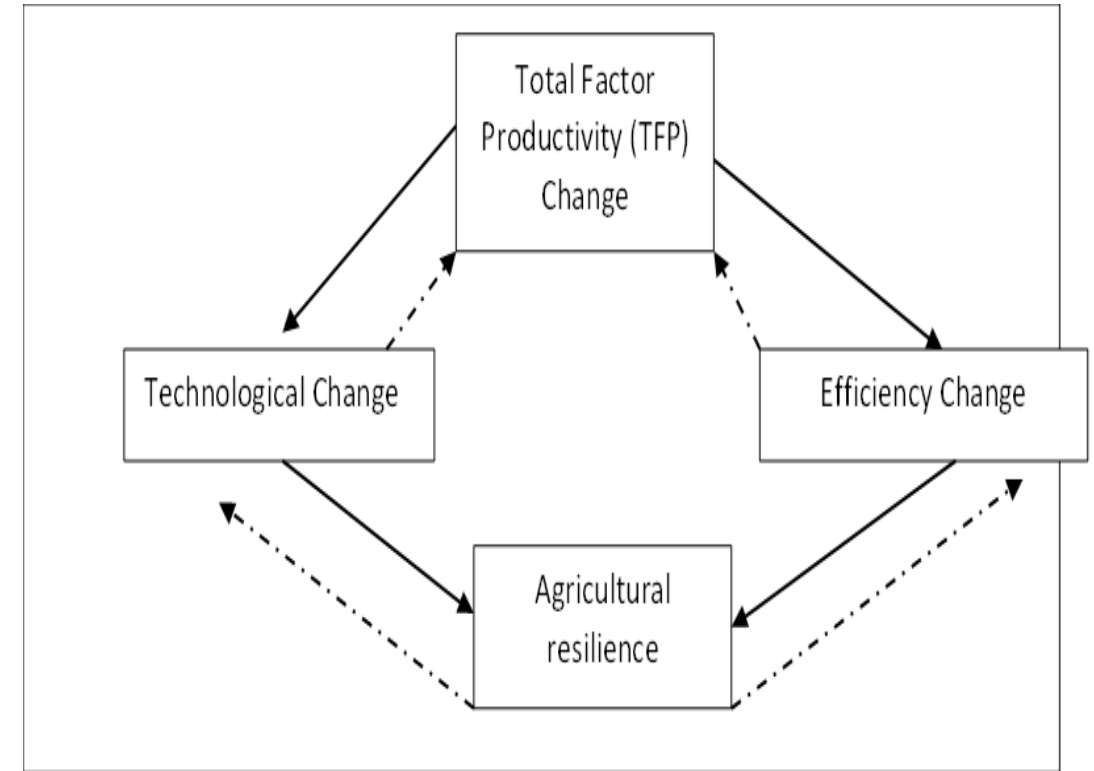
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- CAREC countries build their potential agricultural sector resilience over a long time. However, the actual resilience of the sector is **revealed at the time of shocks**.
- We explore the resilience of CAREC country's agriculture when faced with global shocks: **Global Financial Crisis(2008-2009) and COVID-19 pandemic (2020)**.
- **How do CAREC countries agriculture sectors respond to shocks? What are the drivers of resilience? & What lessons can we draw for similar future shocks?**
- We assess **8 CAREC countries** agricultural resilience to shocks: Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, and Uzbekistan.
- We apply the **analytical framework developed by Zawalińska et al. (2021)** that links revealed resilience to shocks with changes in Total Factor Productivity (TFP) index

Approach

- **Revealed resilience** describes the capacity of the ag. System to withstand shocks while maintaining essential functions and structure during crisis.
- **TFP** is an index that measures aggregate ag. Output (value added) per unit of aggregate inputs (labour, land and capital)
- TFP is decomposed into **Technological Change**(innovation) & **Efficiency Change** (quality & scope)
- Resilience interacts /**linked** to TFP dynamics (*two-ways*).



Source: Adapted from Zawalińska et al. (2021: p4)

Approach

<i>Resilience capacities for</i>	<i>Relation b/n changes in TFP and its composition and revealed resilience</i>	<i>Definition</i>
<i>Ag. system</i>	TFP < 1 is decline, TFP=1 is stagnant, TFP>1 is a progress	
Robust	<ul style="list-style-type: none"> - if TFP is non-declining (stays the same or it grows) - TC and EC components of the TFP are maintained in similar proportions as before the shock 	system has the ability to <i>maintain the essential functions without significant changes</i> to its internal components and processes (Urruty et al.2016)
Adaptable	<ul style="list-style-type: none"> -if TFP is non-declining -the TC and EC composition show substantial changes 	system is able to adapt internal elements and processes in response to changing external circumstances and thus continue to develop along the previous trajectory while maintaining all vital functions (Folke et al. 2010)
Transformable	<ul style="list-style-type: none"> -If TFP is declining and the TC & EC components have no substantial contributions to the TFP growth, the system is not robust. Thus, the system needs to adapt. -If the TFP is declining even when the composition changes, then a more extensive transformation of the system. 	system is unsustainable or dysfunctional and when the system needs to develop or incorporate new elements and processes that alters the operational logic to maintain essential functions (Walker et al. 2004).

Source: adapted from Zawalińska et al. 2021

- compiled 20 years input data (ag. labour, land & capital) & agriculture output data from the FAO, World Bank, and National statistics to estimate the TFP indices.
- estimated the annual agriculture TFP index and TC and EC composition for each country for 2000-2020 using Malmquist TFP index formula.

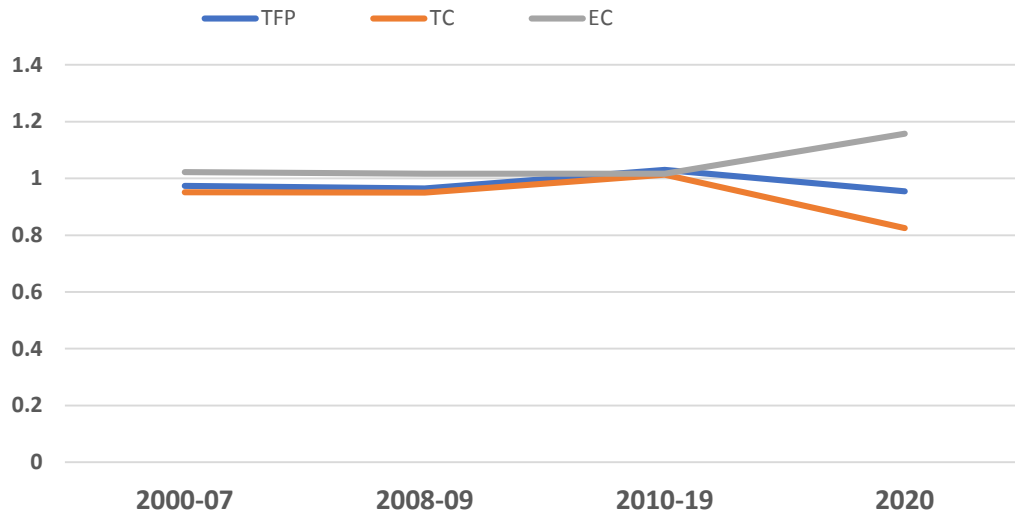
Expression: $m = (x^t, y^t, x^{t+1}, y^{t+1}) = (TC) \times (EC)$

$$\text{where, } TC = \left[\frac{d^t(x^{t+1}, y^{t+1})}{d^{t+1}(x^{t+1}, y^{t+1})} \times \frac{d^t(x^t, y^t)}{d^{t+1}(x^t, y^t)} \right]^{1/2}, \text{ and } EC = \frac{d^{t+1}(x^{t+1}, y^{t+1})}{d^t(x^t, y^t)}$$

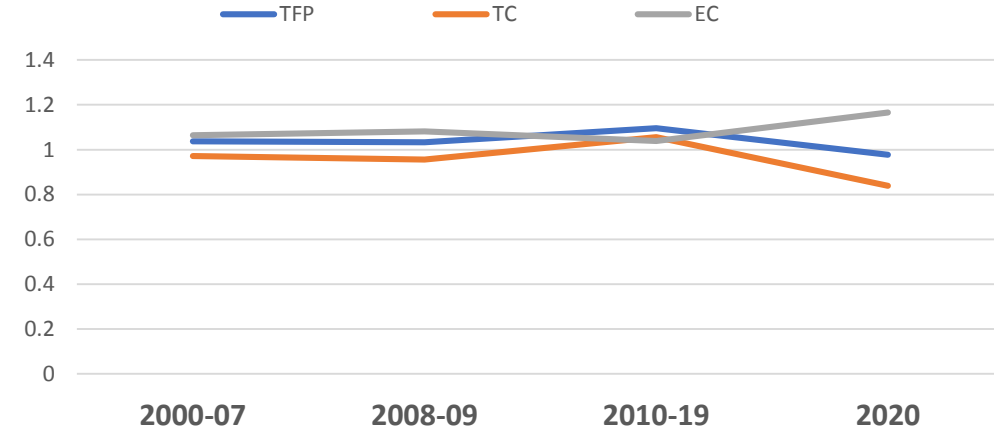
- aggregated the annual TFP changes for each country in four periods. (i) Before the GFC(2000-2007) (ii) **During the GFC,(2008-2009)** (*external shock 1*), (iii) After the GFC but before the COVID-19 pandemic, 2010-2019, and (iv) **the global COVID-19 pandemic**, the year 2020 (*external shock 2*).

Result of TFPC, TC & EC

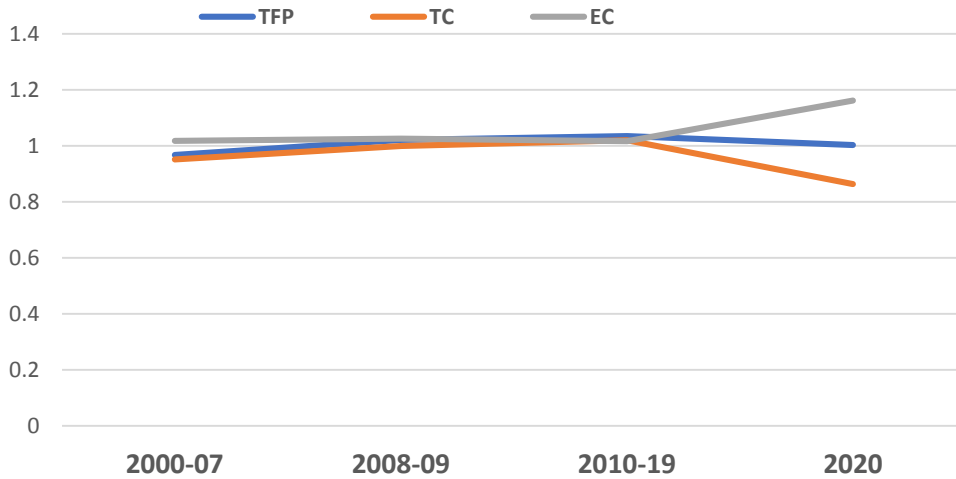
1. Azerbaijan



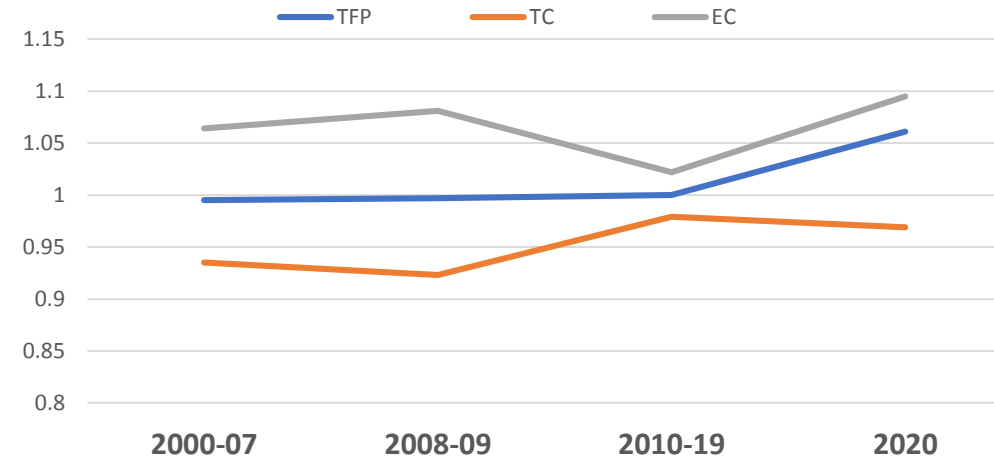
3. Mongolia



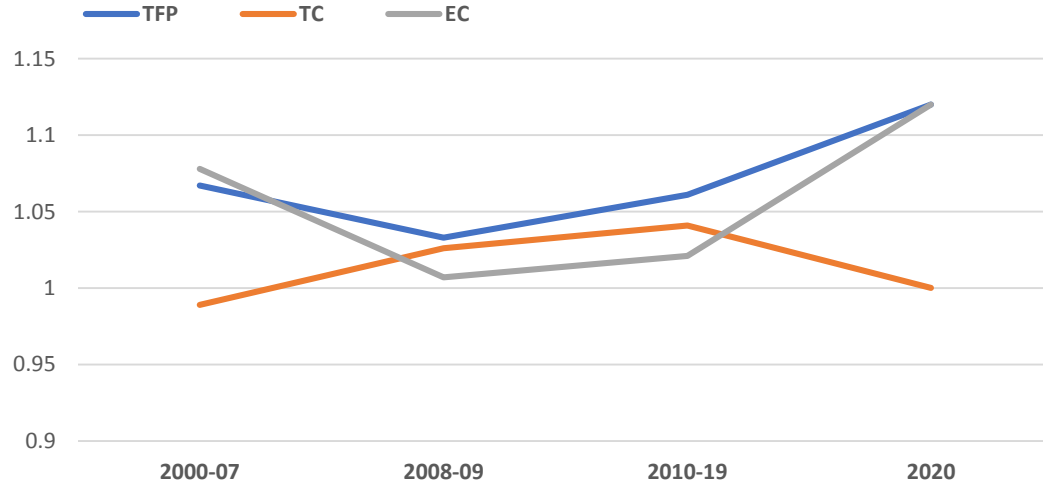
2. Georgia



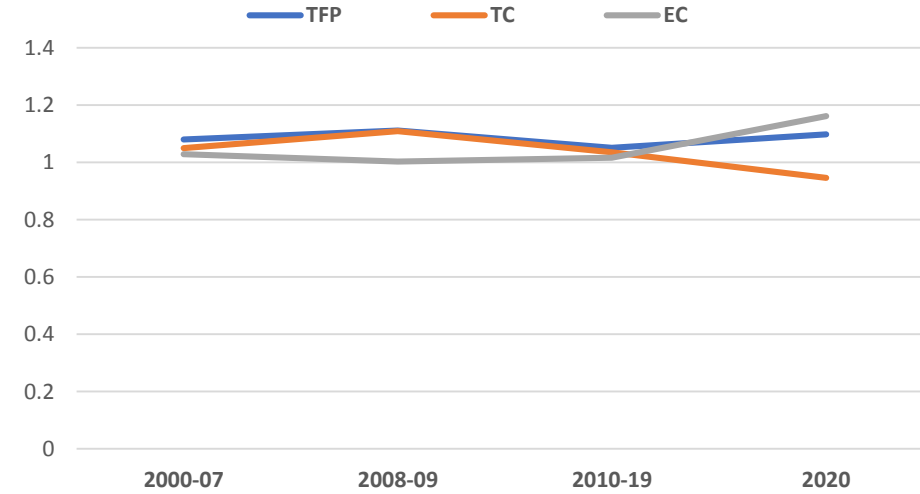
4. Pakistan



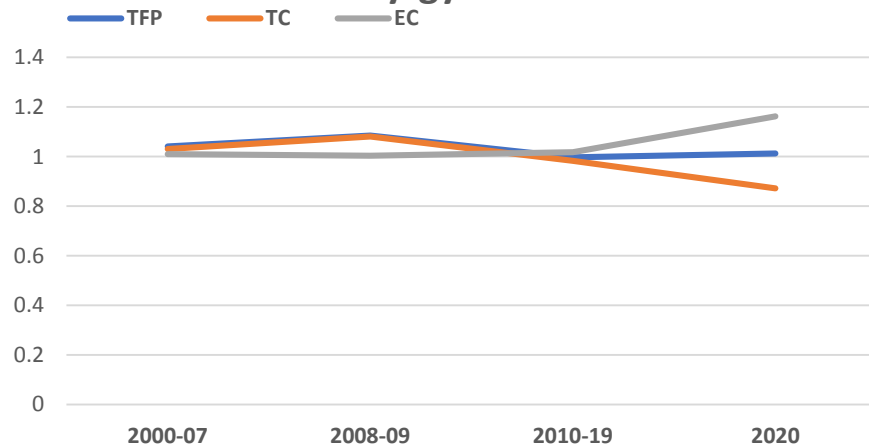
5. Kazakhstan



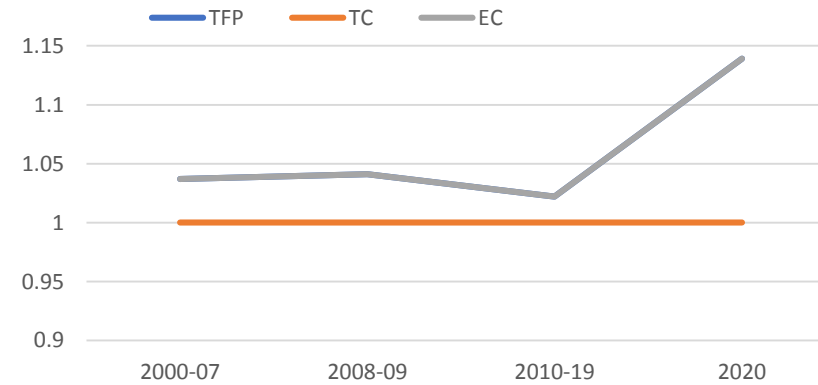
7. Tajikistan



6. Kyrgyzstan



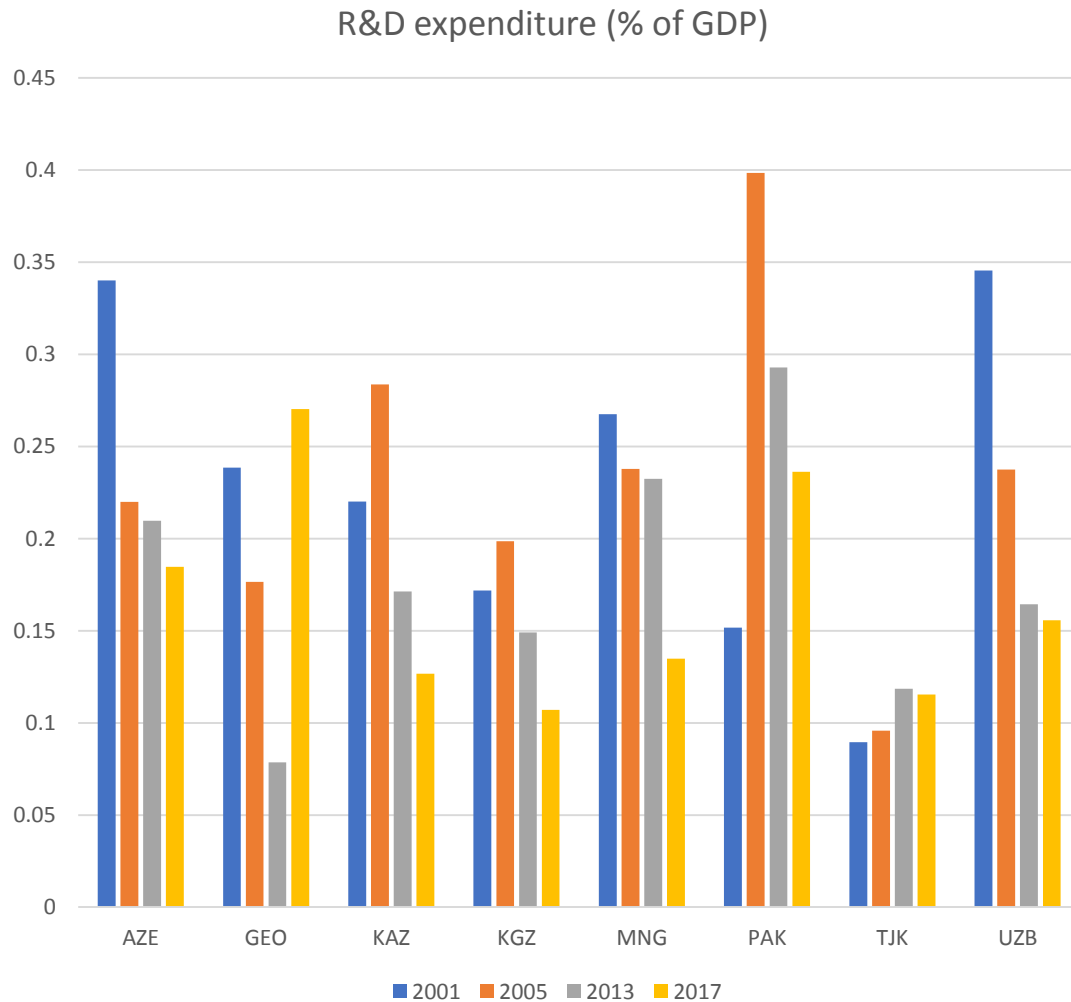
8. Uzbekistan



Link TFP with resilience to shock

	Azerbaijan	Georgia	Kazakhstan	Kyrgyzstan	Mongolia	Pakistan	Tajikistan	Uzbekistan
2008-2009 GFC	TFP<1 TC<EC need to adapt	TFP>1 TC<EC robust	TFP>1 TC>EC adaptable	TFP>1 TC>EC robust	TFP>1 TC<EC robust	TFP<1 TC<EC need to adapt	TFP>1 TC>EC robust	TFP>1 TC<EC robust
2020 COVID-19	TFP<1 TC<EC need to adapt	TFP>1 TC<EC adaptable	TFP>1 TC<EC adaptable	TFP>1 TC<EC adaptable	TFP<1 TC<EC Need to transform	TFP>1 TC<EC robust	TFP>1 TC<EC adaptable	TFP>1 TC<EC robust

- Countries have varied revealed resilience capacities to shocks and between shocks
- Most countries that showed resilience maintained their TFP growth by increasing their efficiency
- The study has valuable implications for informing agricultural policies on building agriculture resilience
- Encourage progress in TC component of TFP with agriculture innovations. Thus improving expenditure to promote ag. research and science
- need to focus on adopting the right productivity boosting strategies to increase resilience capacities before and during shocks including technical and institutional innovations and efficient use of scarce resources, support high productivity sub-sectors, labour productivity skills

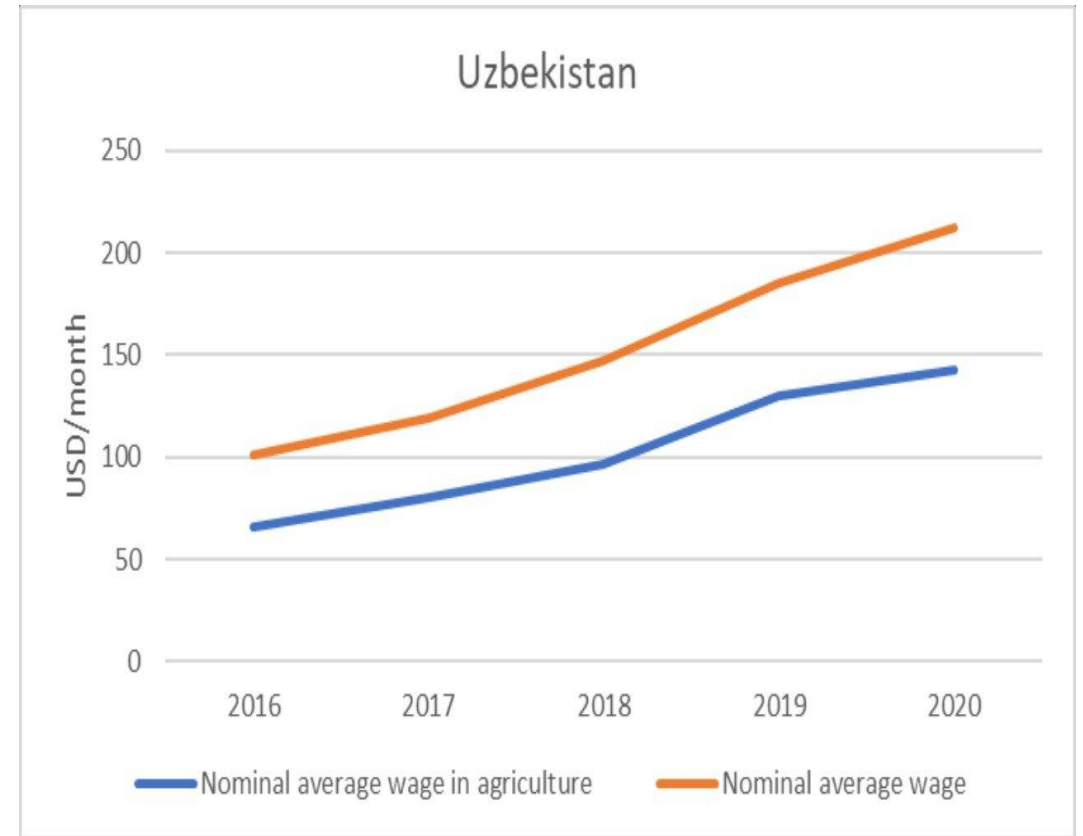


- Low expenditure for R&D in the CAREC countries cause for low TC contribution to TFP (Israel & Korea 5%).
- Continue investing in skills & education (PAK 40% of pop. While AZE, KAZ and UZE have above 95% of population with secondary level education).
- Our study made us question the dominant theories on link between efficiency and market reforms? less reliance on subsidies?, minimum wage?

- Land ownership/ reforms...

Agricultural land tenure			
	Only state ownership	Only private ownership	Mix
Azerbaijan			x
Georgia			x
Kazakhstan			x
Kyrgyzstan		x	
Mongolia	x		
Pakistan		x	
Tajikistan	x		
Uzbekistan	x		

- Minimum wages....



Thank You !!

This is an on-going work. Any input is welcome.

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