Economic growth and healthy eating: some international evidence and implications for emerging countries

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Abstract

We analyze the effects of healthy eating on productivity. By using panel data econometrics ($PVAR$), we find the impact on productivity is positive and statistically significant worldwide, but it follows a Kuznets curve: its effect decreases as countries' income increases. Below, in a highly stylized model of economic growth, we show that this productivity impact more than doubles economic growth in a representative emerging economy. The improvement in workers' health is transmitted throughout the economy, favoring especially the owners of capital and, to a lesser extent, workers with more labor and wages.

JEL Codes: I15; O47; O57.

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Introduction

The main objective of this paper is to quantify the effects of healthy eating on economic growth. To meet this objective, we first measured the impact of healthy eating on productivity in a large set of countries with an econometric panel data model. Second, we introduce this productivity quantification into a highly stylized growth model and, thus, obtain the final effects on the economy and welfare for a representative emerging economy.

The literature has focused extensively on the effects of the obesity pandemic, indicating that there is a Kuznets curve between (Aydin (2019) and Grecu and Rotthoff (2015)) and within countries (Lakdawalla and Philipson (2009)): as per capita income increases, the effects of obesity tend to be reduced, since health issues tend to prevail. The evidence is important in developed countries, and to a lesser extent in emerging and developing countries, which present not only obesity problems but also a simultaneous lack of nutrition (Ford, Patel, and Narayan (2017), Prentice (2006) and Popkin (2001)), problem known as the double burden of undernutrition and overnutrition (Abdullah (2015)). Thus, our contribution to the existing literature is to measure the gains that would be obtained by changing the food diet of the workforce, to face this double burden in emerging economies.

In this regard, the study focuses on two interlinked methodologies. First, we measure with a Panel Data VAR, $PVAR$ based on Jorda (2005), the impact and dynamic effects of a 1% shock in the consumption of different types of food on productivity in different countries. This shock can be interpreted as an exogenous change in preferences itself (rational and/or behavioral) and/or in prices, capturing empirically much of the elements that have been studied in the literature to explain eating habits (examples of alternative approaches are Kirchengast and Hagmann (2021), Cawley (2015), Otero, et al (2015), Ruhm (2012), and Drewnowski and Darmon (2005)). The $PVAR$ results confirm the Kuznets for healthy eating: the effect on productivity is positive and statistically significant but is smaller as we consider countries with higher incomes. In this regard, Mazhar and Rehman (2022) and Kelly, Doytch, and Dave (2019) find similar results with panel data but for the case of obesity.

Secondly, based on the previous result, we focus on upper-middle income countries, where most emerging economies are located. Especially for this reason: upper and lower-middle income countries have a characteristic that reduces the multiplier effect of a healthy diet as a source of economic growth. In the first group of countries, these are capital-intensive; in contrast, in the second group of countries, the production of goods tends to be labor-intensive and, often, with significant dietary deficiencies. Emerging countries are midway between these two cases in terms of capital intensity: thus, an improvement in the quality of the food diet can be transmitted directly to capital productivity and thus strongly to the rest of the economy.

In this regard, we propose a simple, novel, and highly stylized growth model in the spirit of those presented in Acemoglu (2008) but for emerging economies in which two types of households coexist: capitalists who do not work and invest and workers who must work to finance their consumption. The labor of this household can produce goods if and only if it is fed enough to obtain the necessary energy (Bloom, Canning, and Sevilla (2004)), formalizing the idea adults need certain minimum standards of energy to perform basic life-sustaining function, see Shetty (2005) for more details. The available foods are close substitutes, and their consumption depends on preferences, relative prices, and disposable income. However, we introduce into the modeling the relationship between food and health (a selective review can be found in Cawley (2015)), in other words, different types of food have different effects on the health of workers, i.e., while all foods potentially serve as a source of energy, the net effect depends on whether they have a negative effect on health.

Calibrating the parameters of the model with average values for emerging economies and solved in non-linear terms, we find that the gain of approximately 1.1% in productivity, due to the improvement of the food diet, causes GDP to become 2.5% higher than its initial level. The increase in productivity impacts positively on capitalist households because they hire more productive labor, and thus can quickly and permanently raise their consumption and welfare. On the side of working households, the effects are more gradual, but also important, to the extent that capital stock increases, and with it wages rise, these households reach higher levels of consumption. Although in relative terms they record lower welfare gains due to the effort to provide more work.

The paper is organized as follows: section 1 presents the econometric evidence, section 2 develops the model, and section 3 concludes and explains the limitations of the study.

1 Some international evidence

The econometric methodology used for this study was the local projection method (LPM)to estimate impulse response functions (see Jorda (2005)). The LPM allows us to recover the dynamics of the dependent variable after a shock, and it has been widely used in empirical macroeconomics, (see for example Auerbach and Gorodnichenko (2012); Ramey and Zubairy (2018); and Alesina et al. (2020)).

The LPM method is based on the predictions of a panel of VAR or $PVAR(p)$ data over a h horizon with p lags. Thus the model becomes a $VARMA$, in that through simple linear estimation, the LPM (Hansen (2022), page 537) reduces the risks of misspecification of the data generating process (Jorda (2005)), from other alternatives, for example, using a priori a VAR model that imposes the linearity restriction and in which the impulse response functions are recovered with short-run, sign, or long-run assumptions on the parameters, which in our particular case it is not obvious to impose any of these restrictions. The benchmark regression is specified as follows:

$$y_{j,i,t+h} - y_{j,i,t-1} = \alpha_{j,i} + \beta \Delta P_{j,i,t} + \nu X_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where, $y_{j,i,t+h}$ is the outcome variable of interest — in our case productivity— for consumption of food j, country i at time $t+h$ (i.e., the prediction horizon is h.), $\alpha_{j,i}$ is country fixed effect to control for unobserved cross-country heterogeneity, $\Delta F_{j,i,t}$ is the change in a proxy for the for consumption of food j, $X_{i,t}$ is a vector of control variables, which includes the changes in the dependent variable, and the other variables: output, private consumption, labor share, and hours worked, and ε is an unexplained error.

The most relevant coefficient is β, the impulse responses of productivity to changes in the consumption of each type of food. The impulse responses were constructed by plotting directly the β coefficient for five predictive regressions, i.e., from $h = 1$ to $h = 4$, of equation (1) with four lags $p = 4$ for the following yearly sample: 1990-2018. Then, confidence bands were based on the respective estimated standard errors. Finally, the countries were selected according to criteria defined by the World Bank (WB) and food consumption data is from The Institute for Health Metrics and Evaluation ($IHME$), the original food series is measured in grams.

The results of the $PVAR$ impulse responses are shown in figures 1, 2, and 3, table 1 summarizes the maximum impacts of the impulse responses that are statistically significant. In almost all cases, a 1% increase in the feed of one type of product leads to an increase in productivity, regardless of country classification. For the implications on the effect on economic growth, it is very important to note that the effect on productivity also tends to have a shape of an inverted "v" as observed in all figures. In other words, the increase in food produces effects on the level of productivity in each of the groups of countries considered.

Next, table 1 indicates a phenomenon that is difficult to observe with impulse response functions. In this table we arbitrarily classify foods into two groups: healthy and unhealthy foods. We then average by group, as an indicator of diet rather than the effect of separate products, the productivity increases of the maximum effects that are statistically significant. Next, we obtain the productivity differentials between the two food groups. The effects are as expected, healthy food outperforms unhealthy food in terms of productivity gains and this gain is inverse to income levels. Thus, productivity gains are twice as large in middle- and high-income countries, and up to three times as large in lower-middle-income countries relative to high-income countries.

Two of the $PVAR$ results are counter intuitive: the strong positive effect of sodium in emerging countries and the negative effect of red meat in lower-middle-income countries. In this regard, we consider these results to be only indicative but extreme values, taking into account the following elements. If the effect of red meat were zero, as shown in figure 3 for almost all years, the net effect on productivity would be 2.3% instead of 2.6 % in lower-middle-income countries, i.e., a more realistic value would be closer to 2.0% than 2.5%. In the case of sodium, often associated with junk food, if we take, on the one hand, the average between the maximum feasible value in productivity in developed countries (3.0%, which is the mean plus one standard deviation, due to the effect of disproportionately high sodium intake in these countries, see figure 1) and the maximum value in emerging countries (6.5%), the net productivity gain would be 1.1% instead of 0.8%. On the other hand, if we take only the maximum feasible value in developed countries (3.0%), net productivity gains reach 1.4%, i.e., a more realistic value for total productivity gains would be above 1.0%.

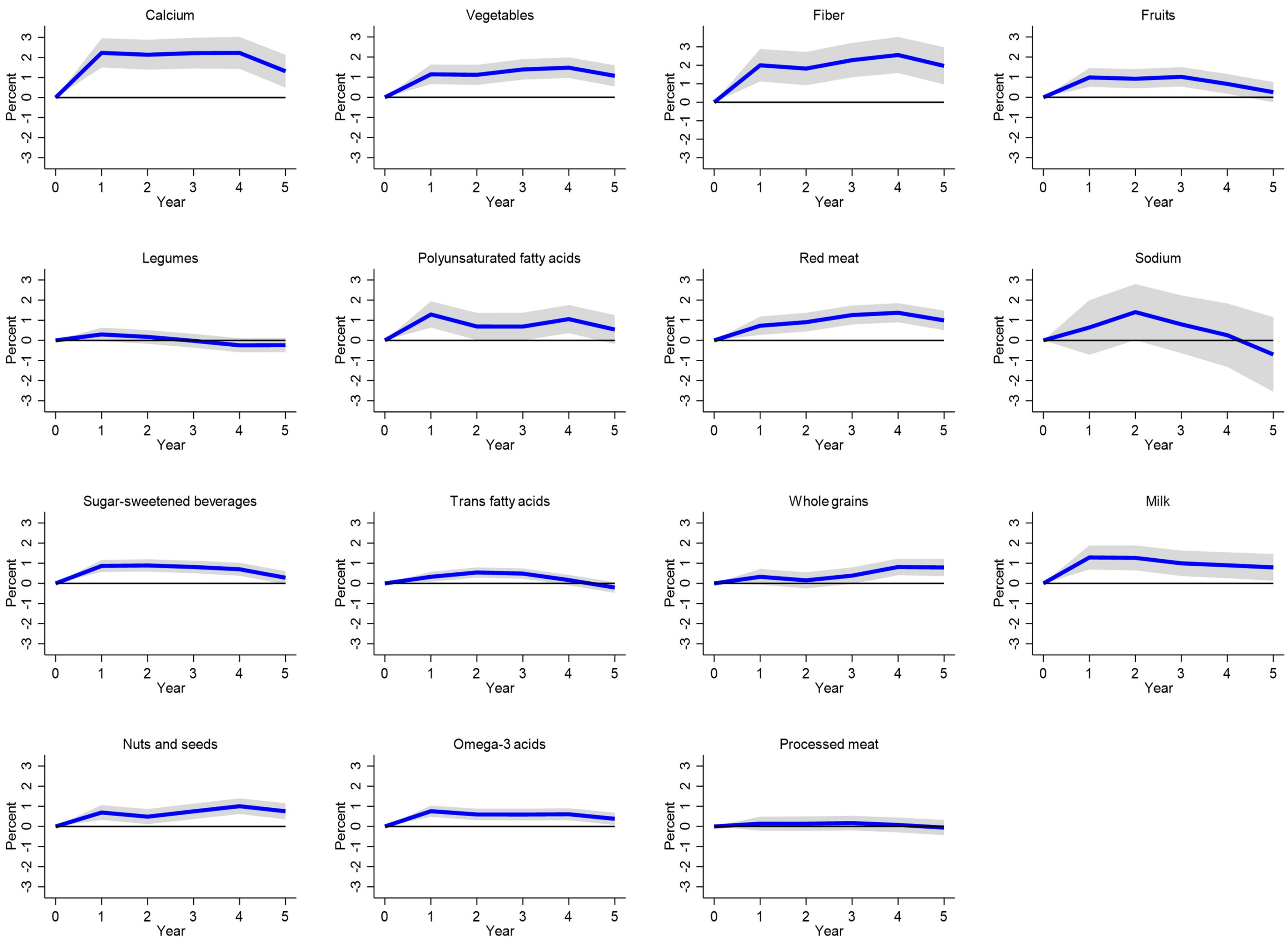
The evidence of the $PVAR$ indicates that there is a Kuznets curve at the level of healthy eating worldwide, which is consistent with the evidence found for obesity. As income increases, the impact of healthy eating decreases.

Table 1: Maximum and statistically significant effect of different types of feed on productivity according to $PVAR$ model

Food	Countries		
	High Income	Upper-Middle Income	Lower-Middle Income
Healthy			
Calcium	2.2	4.3	5.1
Vegetables	1.5	2.3	1.4
Fiber	2.6	5.9	3.0
Fruits	1.0	3.9	1.3
Legumes	0	0	0.9
Milk	1.3	2.2	3.2
Nuts and seeds	1.0	1.7	2.2
Omega 3	0.8	2.6	2.3
Fatty acids	1.3	4.7	3.0
Average productivity change (1)	1.3	3.1	2.5
Unhealthy			
Red meat	1.4	2.3	-1.9
Processed meat	0.2	1.0	2.4
Sodium	1.4	6.5	-6.5
Trans fatty acids	0.5	-1.2	0.8
Whole grains	0.8	2.6	3.1
Sugar	0.9	2.2	1.3
Average productivity change (2)	0.9	2.2	-0.2
Net change in productivity (1)-(2)	0.4	0.8	2.6

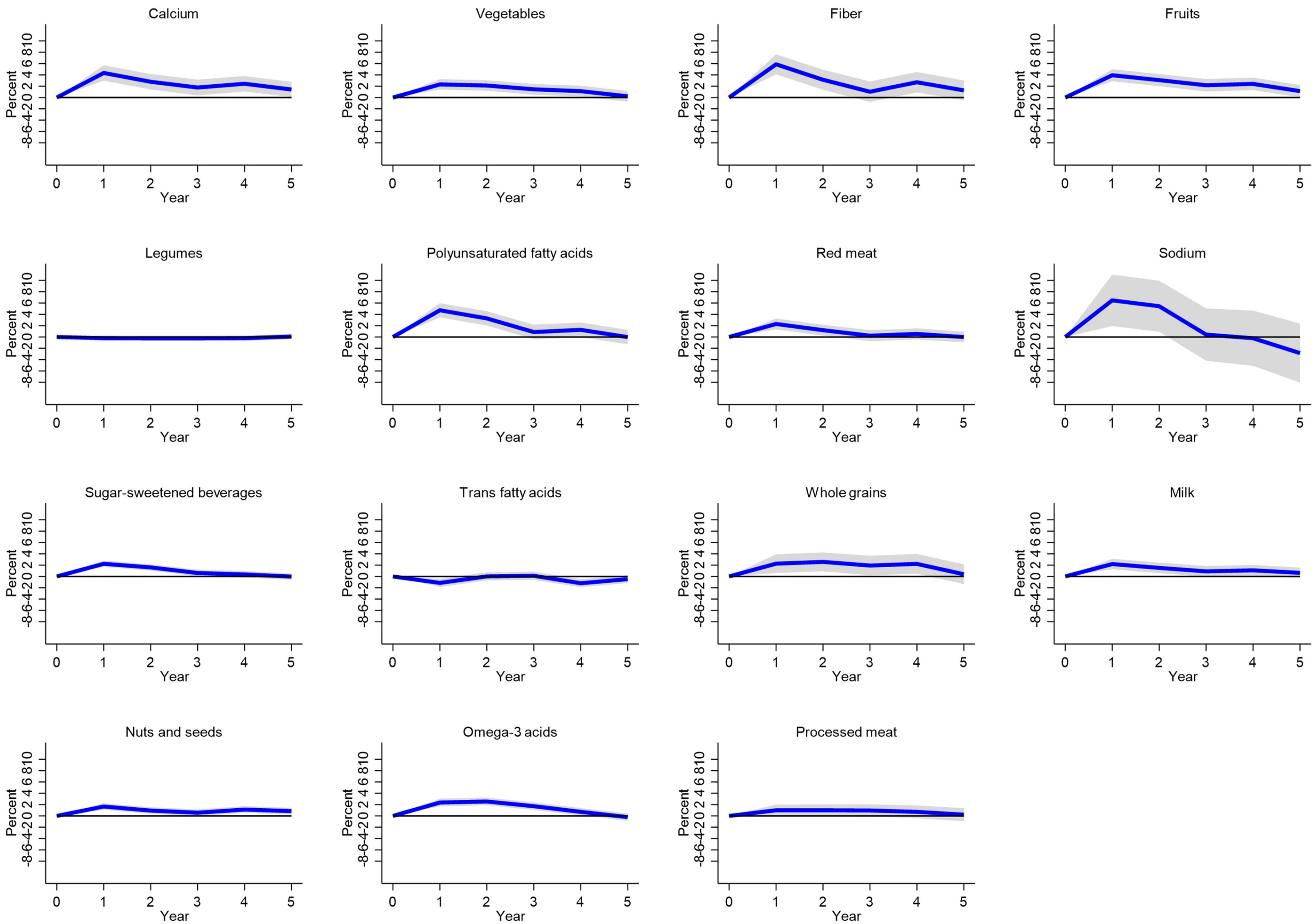
Source: Authors' calculations based on the $PVAR$ Model presented in section 1.

Figure 1: Impact of a 1% increase in the feeding of different foods on productivity: high income countries.



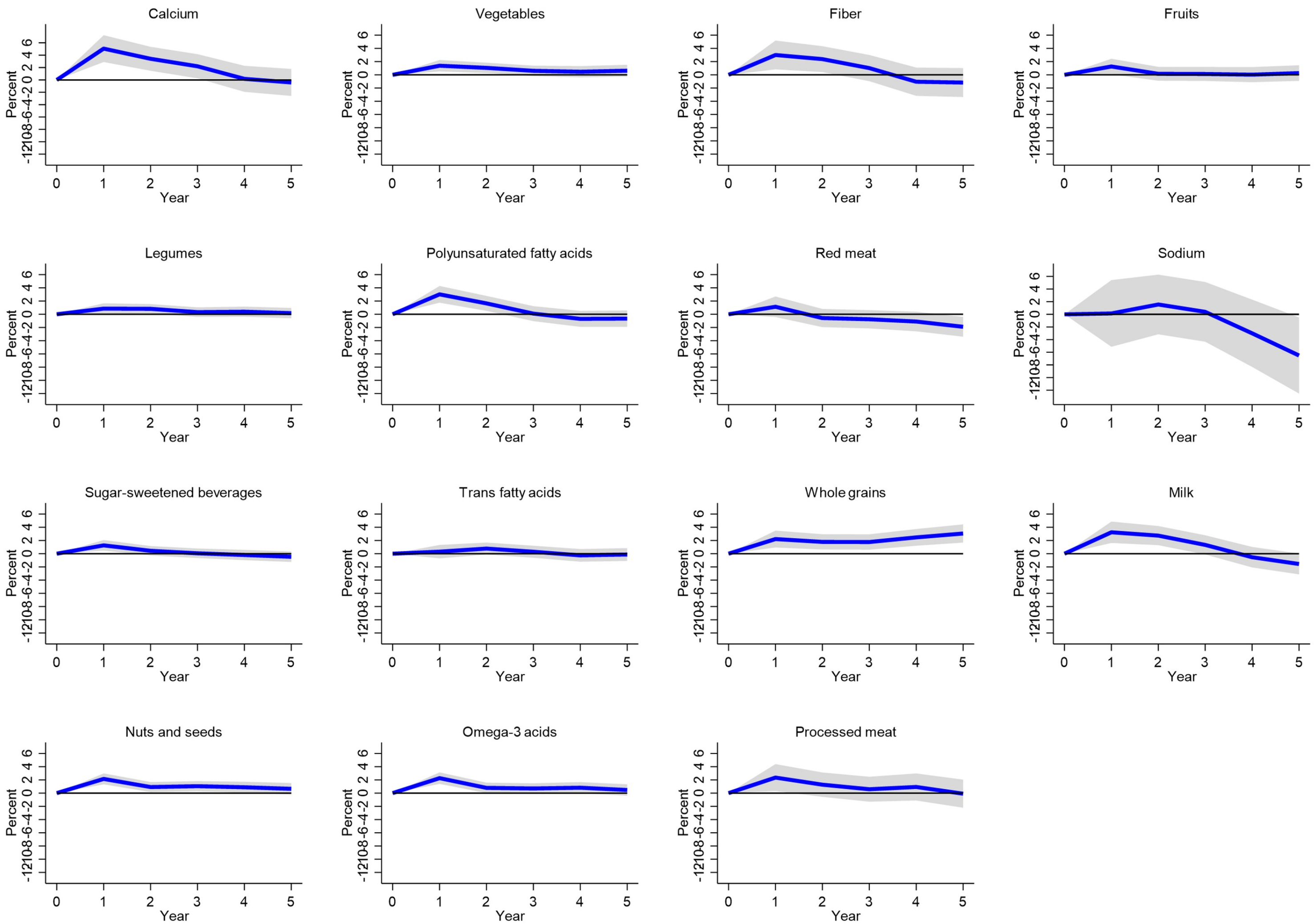
Source: Authors' calculations, based on the $PVAR$ model presented in section 1.

Figure 2: Impact of a 1% increase in the feeding of different foods on productivity: upper-middle income countries



Source: Authors' calculations, based on the $PVAR$ model presented in section 1.

Figure 3: Impact of a 1% increase in the feeding of different foods on productivity: lower-middle income countries.



Source: Authors' calculations, based on the $PVAR$ model presented in section 1.

2 Implications for economic growth and welfare in emerging economies

2.1 Economic growth model for emerging economies

In this section we present a stylized model of economic growth for emerging economies that takes the empirical result of the previous section. This model meets some characteristics of these emerging countries that are not considered in versions for developed economies (see for example Acemoglu (2008): i) they are economies where there are important differences between capitalists and workers, ii) open to the trade of goods and capital, iii) wealth effects on labor supply are weaker and therefore workers tend to work more than their counterparts in developed countries, and therefore have higher energy requirements, and iv) food consumption expenditure is higher than in developed countries.

2.1.1 Households

We separate the economy into two types of households: capitalists who only consume, invest, and hire labor to produce goods. These households own the capital, the firms that produce goods and borrow abroad to smooth their consumption, and produce capital. We assume that these households are all identical and jointly solve this non-stochastic problem:

$$\max_{\left\{C_t^K, B_{t+1}^*, K_{t+1}\right\}_{t=0}^{\infty}} \sum\nolimits_{t=0}^{\infty} \beta^t U^K\left(C_t^K\right), \quad U^K\left(C_t^K\right) = \frac{1}{1-\sigma}\left(C_t^K\right)^{1-\sigma} - \frac{1}{1-\sigma}, \tag{2}$$

s.t.

$$C_t^K \leq Z_t K_t - I_t + \Pi_t + \frac{B_{t+1}^*}{R_t^*} - B_t^* - T_t, \tag{3}$$

$$K_{t+1} \leq (1-\delta) K_t + \Theta\left(\frac{I_t}{K_t}\right) K_t, \tag{4}$$

where C_t^K is the consumption of all capitalist households, Z_t rental price of capital, K_t is capital stock, $\Theta\left(I_t/K_t\right)$ is a function representing quadratic adjustment costs of investing, I_t investment, Π_t the profits of firms producing goods, B_t^* external debt, T_t taxes, and R_t^* interest rate. This last variable is in turn:

$$R_t^* = R^* + \xi\left[e^{\left(B_{t+1}^*/Y_t - B^*/Y\right)} - 1\right], \tag{5}$$

where R^* is the steady state interest rate and is equal to $1/\beta$, B_{t+1}^*/Y_t is the ratio of external debt to GDP, B^*/Y is the same ratio, but in steady state, and ξ is a parameter that measures the sensitivity of the interest rate to indebtedness above its steady state level.

The quadratic costs are in turn:

$$\Theta\left(\frac{I_t}{K_t}\right) = \frac{I_t}{K_t} - \frac{\varphi}{2}\left(\frac{I_t}{K_t} - \delta\right)^2, \tag{6}$$

where the parameter δ is the depreciation rate and the parameter measures the adjustment costs of expanding the investment.

The first order conditions are simple and standard, and we express them, after some algebraic simplifications, in the same way as they were written in the computer code:

$$\frac{C_{t+1}^K}{C_t^K} = \left(\beta R_t^*\right)^{\frac{1}{\sigma}}, \tag{7}$$

$$Q_t {\Theta'}_t = 1,\ where\ {\Theta'}_t = 1 - \varphi\left(\frac{I_t}{K_t} - \delta\right),\ and \tag{8}$$

$$Q_t = \left(\frac{1}{R_t^*}\right)\left\{Z_{t+1} + Q_{t+1}\left[(1-\delta) + \Theta_{t+1} - {\Theta'}_{t+1}\left(\frac{I_{t+1}}{K_{t+1}}\right)\right]\right\}, \tag{9}$$

where the Q_t variable is Tobin's Q.

Working households are identical, earn a wage for their labor, have no access to the external credit market, and pay no taxes, jointly solve the following non-stochastic problem:

$$\max_{\left\{C_t^N, N_t\right\}_{t=0}^{\infty}} \sum\nolimits_{t=0}^{\infty} \beta^t U^N\left(C_t^N, N_t\right), \quad U^N\left(C_t^N, N_t\right)=\frac{1}{1-\sigma}\left(C_t^N-\psi \frac{N_t^{1+\rho}}{1+\rho}\right)^{1-\sigma}-\frac{1}{1-\sigma}, \tag{10}$$

s.t.

$$C_t^N \leq W_t N_t, \tag{11}$$

where C_t^N is the consumption of working households, N_t is labor, and the parameter ψ allows us to calibrate labor appropriately in the nonlinear simulation of the model. We assume that the parameter σ is identical across households, so the difference is that some accumulate capital and others must work, measuring the parameter ρ the disutility of working with the parameter.

The first-order condition of working families is:

$$\psi N_t^{\rho}=W_t, \tag{12}$$

plus equation (11) which defines C_t^N. Consequently, analyzing equation (12), we have that the supply of working households does not consider the wealth effect (i.e., consumption is not present in this equation), and therefore they work more when the wage rises than in the case of standard separable preferences used for developed economies—where higher wealth, i.e., higher consumption, also reduces the labor supply. In short, the aggregate consumption of the economy is:

$$C_t=C_t^K+C_t^N. \tag{13}$$

2.1.2 Firms and food requirements

Firms produce goods Y_t with technology A_t, K_t capital stock, and N_t labor (where $(1-\alpha)$ measures the participation of labor), but, in order to be effective, labor needs energy E_t that comes from food:

$$Y_t = A_t K_t^{\alpha} (E_t N_t)^{1-\alpha}, \tag{14}$$

where energy E_t is a compound that comes not only from food, but also from the effects of this food on health, which we summarize in the function $H(F_t)$.

$$E_t = F_t H(F_t). \tag{15}$$

Therefore, the effect of food is not only the direct effect of providing more energy to work but also its effects on health, measured by the term $F_t\,(dH(F_t)/dF_t\,)$ on the right-hand side of equation (16):

$$\frac{dE_t}{dF_t} = H(F_t) + F_t \frac{dH(F_t)}{dF_t}, \tag{16}$$

thus, the magnitude of equation (16) also depends on the sign of $dH(F_t)/dF$.

The goods-producing firms maximize:

$$\max_{\{K_t, N_t\}} A_t K_t^{\alpha} (E_t N_t)^{1-\alpha} - W_t N_t - Z_t K_t, \tag{17}$$

and the first-order conditions are:

$$(1-\alpha)\frac{Y_t}{N_t} = W_t, \tag{18}$$

$$\alpha \frac{Y_t}{K_t} = Z_t. \tag{19}$$

2.1.3 Consumption and the food market

Working families make decisions about consumption levels of each type of food $F_{t,i}$ [1]:

$$F_{t,i} = \theta_{t,i} \left(\frac{P^F_{t,i}}{P^F_t} \right)^{-\eta} F_t, \tag{20}$$

where $P^F_{t,i}/P^F_t$ is the relative price of the type of food i, $\theta_{t,i}$ is a parameter that defines the preferences for one type of food or another, and the parameter η is the price elasticity of demand for food. In addition, it is assumed a unit income elasticity and that each of the prices $P^F_{t,i}/P^F_t$ are determined in international food markets. Therefore, we can separate the effects on $F_{t,i}$ of equation (20) into two components, an endogenous one defined by F_t, which in turn is part of C^N_t, and a purely exogenous one set by $\theta_{t,i}$ and/or $P^F_{t,i}/P^F_t$.

These last two elements allow us to directly connect the results of the $PVAR$ with the model of this section. In other words, changes in $\theta_{t,i}$ and/or $P^F_{t,i}/P^F_t$ represent exogenous shocks in consumption by type of food $F_{t,i}$, since we control for the endogenous component in the empirical exercise, i.e. , F_t,by other variables (aggregate consumption, GDP, investment, etc.).

2.1.4 Equilibrium and link between the growth model and the $PVAR$ model

Putting equations (3) and (10) together, and assuming that $G_t = T_t$, in which G_t is government spending, we have the equilibrium of the economy:

$$C_t = Y_t - I_t - G_t + \frac{B^*_{t+1}}{R^*_t} - B^*_t. \tag{21}$$

How does the increase in food consumption measured by PVAR work in the model?

First, we define the effect of the simulated feeding sequence $\{E_t\}^T_{t=0}$ on productivity

[1] We assume that $F_t = \left[\int_0^1 \theta_{t,i} \left(F_{i,t} \right)^{1-\frac{1}{\eta}} di \right]^{\frac{\eta}{\eta-1}}$, where η is the elasticity of substitution, and, therefore, from the process of minimizing food expenditure we obtain $P^F_t = \left[\int_0^1 \theta_{t,i} \left(P^F_{i,t} \right)^{1-\eta} di \right]^{\frac{1}{1-\eta}}$ and equation (20).

by $\left\{\tilde{A}_t\right\}_{t=0}^{T}$, which is obtained directly from $PVAR$. If this sequence is introduced in equation (14) the sequence $\{Y_t\}_{t=0}^{T}$ is generated as a function of E_t, because $Y_t(E_t) = \tilde{A}_t(E_t) K_t(E_t)(N_t(E_t))^{1-\alpha}$, where $\tilde{A}_t = A_t(E_t)^{1-\alpha}$, and the trajectories of $K_t(E_t)$ and $N_t(E_t)$ are also functions of E_t.

Second, according to equations (17) and (18), productivity increases are transmitted to direct increases in prices $W_t(E_t)$ and $Z_t(E_t)$, which again are functions of E_t. Then, if one looks at the first order conditions (8), (9), and (11) we see that there must also be increases in $N_t(E_t)$ and $I_t(E_t)$ for the horizon $t = [0, T]$.

Third, if one looks at figures (1), (2), and (3) of section 1 we can see that the shape of the effect of E_t on $\tilde{A}_t$ over a 5-year horizon has the shape of an inverted $''v''$ in the case that the effect is positive or of a $''v''$ in the case that the effect of E_t is negative, considering only the sections in which the impulse responses are statistically significant. Thus, since the $PVAR$ was estimated in first differences, the effect of E_t on $\tilde{A}_t$, whether positive or negative, is permanent.

In terms of the model, a permanent change in $\tilde{A}_t$ is a change in the economy from one stationary equilibrium to another. Looking at equation (7) we have that the transition from one stationary equilibrium to another should produce a jump in capitalist household consumption $C_t^K(E_t)$, but then it should remain relatively stable over time, and with this we should not expect a major change in the interest rate $R_t^*(E_t)$.

Finally, knowing the sequences of $C_t^K(E_t)$, $C_t^N(E_t)$, and $N_t(E_t)$ for horizon $t = [0, T]$ that generate the effect of E on A we can calculate for that horizon the welfare effect by household type using the utility functions of (2) and (10):

$$W_t^i(E_t) = U_t^i(E_t) + \beta W_{t+1}^i(E_{t+1}), \quad i = K, N. \tag{22}$$

2.2 Non-linear simulation of the growth model in practice.

The model is solved using the standard Newton's method with sparse matrices (Heer and Maussner (2009)), in particular, we use the homotopy –or divide-and-conquer– technique to simulate the model, and values for the parameters from table 2. For the application of this method, we take the current steady state of each economy as our initial values.

To obtain the final simulation values, the initial values were assumed to be those of the steady state without shock and the model was simulated 10^6 times. Next, the simulation was repeated but imposing as final values the vector of values of simulation number 10^4. In other words, the vector of models towards which the model tended after 10^4 periods (years) was imposed as final values.

The parameters are used in the calibration and the initial values for key variables are shown in table 2. Some parameters and initial values were obtained directly from the literature, for example σ, ρ, and ξ (the respective references are mentioned in Table 1). However, others were obtained from information for emerging countries such as α, β (defined by r), B, G, and N. Instead, δ and ξ were calculated to obtain the observed values of the investment to GDP ratio, I/Y , and the volatility of investment, I_t. The initial value of A was adjusted to match an initial value of $Y = 1$, the same is true for to match the initial value of ψ. $E = 1$ was arbitrarily assumed, while $Q = 1$, which is the initial as well as the final steady state value.

2.3 Results

The figure 4 shows the model results for a permanent increase in productivity of 1.1% for 20 years. Based on the arguments given at the end of section 1, we consider a productivity increase of 1.1% to be a conservative value. In other words, we measure the gain from

Table 2: Calibrated Parameters Used in the Model and Initial Points for Key Variables

σ^a	2.0	ρ^a	1.0
β^b	0.98	r^b	0.0195
δ^c	0.02	φ^c	14
ψ^d	4.18	N^d	0.35
ξ^e	0.001	α^f	0.49
Y^g	1.0	A^g	0.5
B^h	0.6	G^i	0.16
Q^j	1.0	E^j	1.0

Notes:[a] Chetty (2006). [b] IMF (2023). [c] Calibrated to obtain the observed values of the inversion ratio of GDP, I/Y, and investment volatility, I_t. [d] This parameter was adjusted to obtain the value of N which was obtained from ILO (2022). [e] García-Cicco, Pancrazi, and Uribe (2010). [f] Our World in Data (2020). [g] $Y = 1$ is arbitrarily chosen, adjusting the value of A, with the previous values of N, K and α. [h] IMF (2021). [i] The World Bank (2022). [j] It was arbitrarily assumed $E = 1$, while $Q = 1$ is the initial as well as the final steady state value.

replacing unhealthy foods with healthy foods, i.e.:

$$\frac{\tilde{A}_t - \tilde{A}_0}{\tilde{A}_0} \times 100 = \sum\nolimits_{t=1}^{20} \left(\sum\nolimits_i^{H} \frac{\tilde{A}_{t,i} - \tilde{A}_{0,i}}{\tilde{A}_{0,i}} - \sum\nolimits_i^{NH} \frac{\tilde{A}_{t,i} - \tilde{A}_{0,i}}{\tilde{A}_{0,i}} \right) \times 100 = 1.1\%, \tag{23}$$

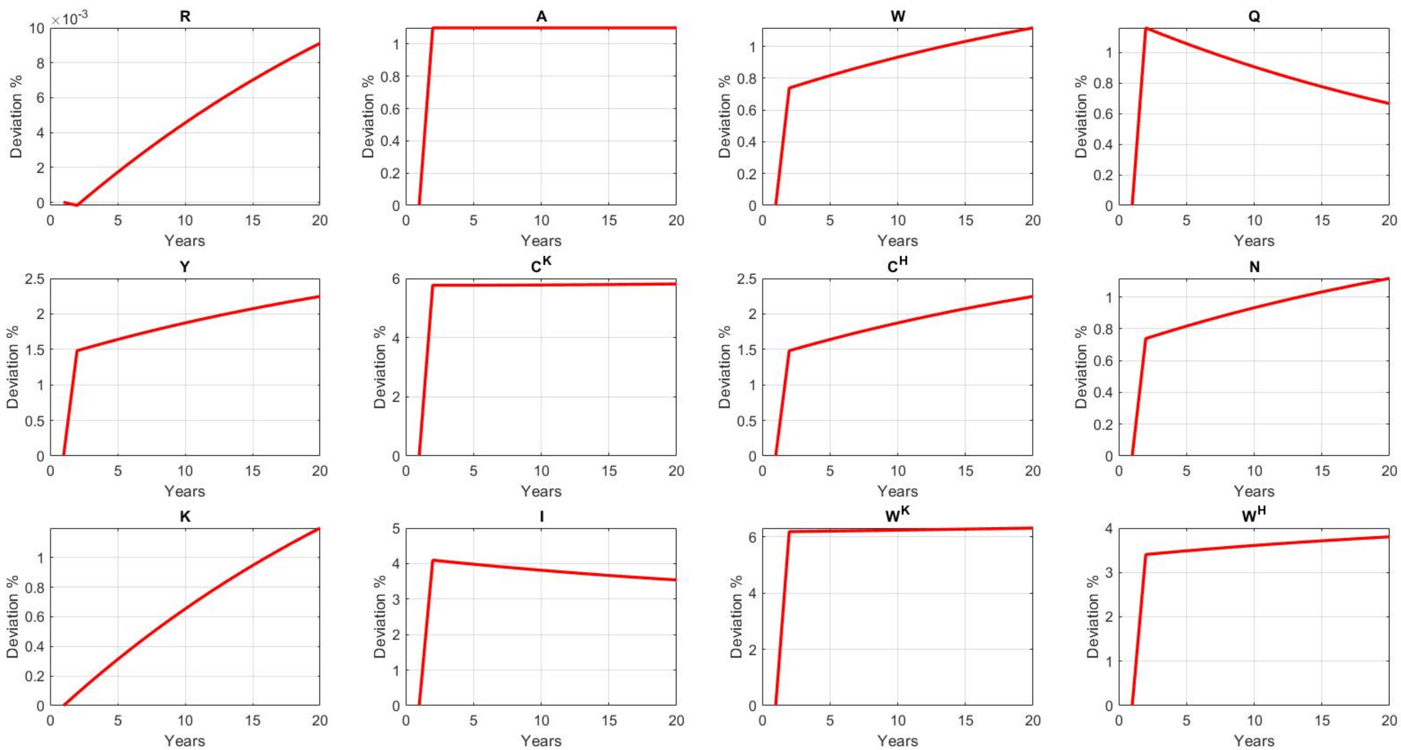
where, H is the subset of foods considered healthy and NH is the subset of foods considered unhealthy. The increase in each of the foods considered in the study is $(F_{ti}/F_{0i} \ - 1) \times 100 = 1\%, \ \forall t \in (0, 20]$, which is the shock that was made in the $PVAR$. On the one hand, we consider the following subset of the empirical study as healthy foods: calcium, vegetables, fiber, fruits, legumes, milk, omega 3, fatty acids, nuts. On the other hand, we consider unhealthy foods to this subset: red meat, processed meats, sodium, trans fats, grains, and sugar. Figure 4 indicates the quantitative results of the productivity increase in the model (all variables are percentages with respect to the initial steady state). Note that the short variable names in figure 4 are the same as those used in the model.

The main conclusion that can be drawn from the results of the simulated economy mechanisms is that the permanent shock in favor of healthy versus unhealthy eating has an effect that spreads gradually over the years. This process, known as second-round effects, substantially boosts the productive capacities of the economy: GDP becomes 2.5% higher than its initial level, recalling that the productivity increase is only 1.1%.

The increase in productivity has a positive impact on capitalist families because they hire more productive labor, and with this they can quickly and permanently increase their consumption (6%), note that, although the interest rate rises, this increase is marginal due to the nature of the shock (9×10^{-3}%). These families decide to strongly increase investment (4%) and, thus, the capital of the economy begins to accumulate gradually (1.2%). On the side of working families, the effects are more gradual, but also important. As capital increases, and with it the marginal productivity of labor, wages (1.2%) and employment (1.2%) also increase simultaneously, allowing for higher levels of consumption (2.2%).

In terms of welfare both households benefit from the change in diet, but capitalist households achieve higher levels of welfare because they only consume and do not have to work. In contrast, working households must work to consume, achieving relatively smaller welfare gains.

Figure 4: Impact of a 1.1% increase in productivity.



Source: Authors' calculations, based on the model presented in section 2.

3 Conclusions and limitations

In this study we found that switching to a healthy diet in emerging economies is not only relevant from a point of view of improving people's health (reducing obesity and/or increasing nutrition) as has been profusely found in the literature but also a source to boost economic growth. Specifically, in our study we explored and quantified the productivity channel, i.e., a healthier diet ensures, in addition to the energy needed for work, better health conditions to perform that same work. In summary, a 1% increase (a shock) in the consumption of this diet —regarding an unhealthy diet— produces an average increase in the level of productivity by 1.1%, a percentage considered conservative, and in GDP by 2.5%, both variables measured relative to their values before the shock.

However, for the sake of simplicity and to enhance the productivity channel we have omitted important issues. First, the consequences of public and tax policies that an emerging country's improvement in the diet of its workers favors more capitalist households, and with higher incomes, is not addressed in the paper's analysis. The following question establishes one of the potential implications: should tax policies be applied to finance subsidies that reduce the cost of healthier foods?

Second, we abstract from the effects of healthy diets on population growth in the model. The introduction of this additional channel could amplify the effects on productivity due to a greater labor supply (and possibly facilitates the adoption of better human capital in children and youths), but it would also complicate the financing of healthier diets, due to the increase in population (Malthusian elements) in developing economies. Elements previously and intensively studied in the literature, for example, by Galor (2005).

Third, within countries there are heterogeneities and elements beyond those established in the model, such as age, gender, westernization of the diet, market reforms that allow the importation of less healthy foods, urban vs. rural, impact of diet on human capital and its endogenous effects, climate change, etc., which the literature has highlighted as relevant in explaining why people decide to consume one diet or another.

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