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Abstract

This paper develops a theoretical model that allows for assessing the poverty impact of the real exchange rate (RER), as an economy-wide relative price, in a fully optimizing model at the household and the firm levels. The model motivates empirical estimation of the response of average household wage and non-wage incomes to RER depreciation/undervaluation. In particular, it is possible to assess the extent to which an RER undervaluation (or RER depreciation) is pro-poor, using a precise metric that compares the rate of change of the income of the poor relative to that of the non-poor in response to RER devaluation/depreciation. We estimate the model using national-level panel data from the Egyptian Central Agency for Public Mobilization and Statistics and the ERF's data bank. We find robust evidence suggesting that strategic real currency depreciation/undervaluation at the macroeconomic level promotes pro-poor income growth at the household level.

JEL Classification: E4, F4

Keywords: poverty, pro-poor growth, household, real exchange rate, Egypt

ملخص

تطور هذه الورقة نموذجا نظريا يسمح بتقييم أثر سعر الصرف الحقيقي(RER) على الفقر، باعتباره السعر النسبي على مستوى الاقتصاد، في نموذج أمثل تماما على مستوى الأسرة والشركات. يحفز هذا النموذج التقدير التجريبي لاستجابة متوسط الأجور المنزلية والأجور الغير مربوطة بالدخل إلى معدل خفض قيمة سعر الصرف الحقيقي. وعلى وجه الخصوص، فمن الممكن تقييم إلى أي مدى يتم بخس سعر الصرف الحقيقي (لصالح الفقراء)، وذلك باستخدام مقياس دقيق يقارن معدل التغير في الدخل من نسبة الفقراء إلى النسبة من غير الفقراء في استجابة لانخفاض قيمة سعر الصرف الحقيقي. نقوم بتقدير النموذج باستخدام بيانات على المستوى الوطني من الجهاز المركزي المصري للتعبئة العامة والإحصاء وبيانات منتدى البحوث الاقتصادية. نجد أدلة قوية تشير إلى أن الاستراتيجية الحقيقية للعملة تبخس بسعر الصرف الحقيقي على مستوى الاقتصاد الكلي والذى يعزز نمو الدخل لصالح الفقراء على مستوى الأسرة.

1. Introduction

The received literature on poverty and human development in general has been substantially focused on the impact of sectoral and micro aspects of poverty reduction. Nevertheless, the importance of macroeconomic policy as determinants of poverty has been increasingly recognized in this literature[1]. If we think of this in terms of fiscal, monetary and exchange rate policy, quite a lot is known about the first two. Fiscal policy through public spending (e.g., on health, education, and infrastructure) can have an important role in poverty reduction as well as growth effects. The importance of monetary policy for growth is well understood, and there is also a large literature on the impact of inflation on poverty, and a lot is written about access of the poor to finance. However, there is very little research on the poverty consequences of the real exchange rate (RER), even though it is well known that real exchange rate policy could have major distributional consequences, being the pivotal economy-wide relative price influencing inter-sectoral transfer of resources.

Despite that there is now a relatively extensive literature on the viability of an RER-led growth and economic diversification strategy[2]; surprisingly, there is very little research on the *direct* potential poverty impact of such a strategy, beyond its *indirect* effect through the growth channel. Moreover, except for Elbadawi (2014), this literature does not specifically analyze the impact of RER undervaluation[3], which, unlike the absolute RER change, entails the "normative" concept of a deliberate development strategy as discussed in the growth and economic diversification literature[4].

At the theoretical level, an RER undervaluation achieved through reduction of the prices of non-tradeables (such as housing and retail services), favors consumers in general, especially the urban poor. Also an RER undervaluation would lead to reallocation of resources toward agriculture, industry and tradable services, raising incomes generated by economic activities in these sectors. To the extent that these sectors tend to generate much more jobs than non-tradable sectors, the RER-led growth of these sectors is also likely to be more pro-poor than overall economic growth in a typical developing economy.

However, RER undervaluation might also generate offsetting-supply-side effects that must be taken into consideration. In the presence of downward price rigidity, the reallocations of investment out of the non-tradable sectors will likely lead to lower real wages. To the extent that a large number of workers are bunched around the poverty line, small drop in real wages might lead to a large increase in both the spread and depth of poverty. Moreover, if the urban poor are also producers of non-tradables, as in the case of the large informal markets in many Middle Eastern and other developing countries, the economy-wide poverty reduction impact on rural poverty may be substantially weakened. Therefore, the net aggregate poverty impact of RER undervaluation could theoretically go either way. Also, the RERunderval effect on poverty might be non-monotonic, because there may exist an RER undervaluation threshold, beyond which

[1] See for example, Agenor (2002), Ali and Thorbecke (2009), Dorosh and Sahn (2000) and Easterly (2003).

[2] See for example, Aghion et al, 2006; Aguirre and Calderon, 2005; Elbadawi et al, 2008; and Rodrik, 2008.

[3] See (Elbadawi et al, 2012) for a formal definition. However, broadly speaking, a country will experience a real currency undervaluation (overvaluation) when it produces a given basket of goods and services that can be traded across international borders at a lower (higher) cost than what would be consistent with its sustainable economic fundamentals -- such as the external terms of trade; the level of sophistication of its economy or the stock of wealth generated by or endowed with the economy. Moreover, real exchange rate (real currency) undervaluation (overvaluation) is consistent with higher price of tradable relative to non-traded domestic goods and services. When an RER is under-or-undervalued, it is necessarily misaligned relative to its long-term equilibrium level.

[4] See for example, Williamson (1997) and Elbadawi and Helleiner (2004).

further undervaluation could lead to higher not lower poverty. An extreme example would be one when RER undervaluation reaches such high levels to the extent that all non-tradable activities disappear. However, the few evidence from the received literature - most notably that of Elbadawi (2014) - suggests that an undervaluation strategy will very likely lead to poverty reduction. Nonetheless, this strand of the literature is rather thin and the evidence remains preliminary at best.

This paper attempts to fill this lacuna by developing a theoretical model based on formal optimizing behaviors at the household and firms levels that are explicitly linked to the real exchange rate as an economy-wide relative price influencing households' allocation of labor and supply of tradable and non-tradable inputs to industry as well as firms' demand for factors of production and supply of goods. The model allows empirical estimation of the response of average HH wage and non-wage incomes to RER depreciation/undervaluation. In particular, it is possible to assess the extent to which an RER undervaluation (or an RER depreciation) is pro-poor, using a precise metric that compares the rate of change of the income of the poor relative to that of the non-poor in response to RER devaluation/depreciation.

We estimate this model using national-level panel data from the Egyptian Central Agency for Public Mobilization and Statistics and the ERF's data bank. We assess the evidence at the detailed HH level, which allows for accounting for HH level controls and testing for a much richer set of hypotheses than could be had when using global country panel data. For example, in addition to testing the fundamental hypothesis of whether or not an RER undervaluation/depreciation is pro poor, we are also able to ask important questions, such as whether or not the RER poverty reducing effect is conditional on the tradability of the economic activity at the HH level (i.e., does RER undervaluation benefit HH working on tradable sectors but harm (or have no effect on) those working on non-tradable sectors?).

This paper, we argue, makes a novel contribution to this literature feature, as there is no other paper we know of that explicitly analyzed the poverty impact of the RER, as an economy-wide relative price, in a fully optimizing model at the household and the firm levels. Moreover, this analysis is highly relevant for policy because it is important to evaluate the extent to which such a strategy is more effective in terms of the poverty goal relative to alternative growth strategies - such as those that favor non-traded activities and, therefore, do not require real currency undervaluation or might even be consistent with RER overvaluation. Moreover, by allowing better understanding of the channels through which RER undervaluation might influence poverty at the HH level, the evidence from this paper should also inform more specific actionable public policy interventions.

The remainder of this paper includes five more sections. Section two undertakes preliminary analysis of the link between real exchange rate undervaluation/depreciation and poverty indicators, using global poverty data as well as Egyptian HH survey data. Section three develops the theoretical model and derives the metric for testing the pro-poor hypothesis of the RER depreciation/undervaluation strategy. Section four estimates two equations for HH wage and non-wage income using five yearly episodes of the Egyptian HH surveys (1999/2000; 2004/2005; 2008/2009; 2010/2011; 2012/2013). In turn, the estimates were used in section five to construct the structural elasticities of the theoretical model. Moreover, section five also formally tests for the pro-poor hypotheses of the RER depreciation/undervaluation strategy for the case of Egypt. Section six concludes and draws some potential policy implications of the paper's findings and discusses relevant issues and extensions for future research.

2. RER and Poverty in Egypt: Data and Preliminary Assessment

The main premise of this paper is that, controlling for the standard factors, a depreciated or undervalued real exchange rate is good for the overarching objective of poverty reduction. In this section we explore the correlation between poverty and the real exchange rate in the global data. In addition, using Egyptian national poverty data, drawn from five cycles of HH surveys, we contrast the dynamics of the Headcount poverty index in Egypt to the global poverty trend. We also explore the possible link between the dynamics of poverty in this country and the extent of RER depreciation/appreciation (or RER undervaluation/overvaluation). To undertake such analysis we first describe three types of data sets that will be used in the analysis of this paper: the global poverty data, the global real exchange rate data and the Egyptian HH survey data and the corresponding poverty measures derived from it.

2.1 The global poverty data

The poverty data is obtained from the WDI database, which reports the Gini coefficient; mean household consumption; and three measures of the head count ratios (the proportion of the population that is poor at the poverty line of $2 and $1.25 dollars per capita and poverty headcount ratio at national poverty line (% of population)). However, to focus the analysis we use only the poverty headcount ratio at national poverty line (% of population), which despite might not being the best for cross-country comparisons, better reflects the real conditions of poverty in the country. The data accounts for 859 poverty spells, covering 122 low and middle-income developing countries. The oldest survey year was 1978 (for India) and the most recent one was 2012 (for Bhutan). The number of spells per country ranges between 22 for Brazil (1981-2007) to only two for a group of 20 countries; while the median number of spell years per country is more than 6, which suggests that the median length of the poverty spell is long enough to reflect medium-run trends in growth and poverty reduction.

Table 1 shows that global poverty has decreased in the year 2011 compared to 2000, while in Egypt it is increased from about 17% to 25%, mainly because income per capita and HH consumption growth has lagged significantly behind the global trends.

2.2 The real exchange rate data

The other central data set for the global analysis is the real exchange rate, obtained from the Bruegel real effective exchange rate (REER) data set, which constructs annual series of CPI-based REER for 178 countries (plus the euro area) as well as monthly series for 53 countries (plus the euro area)[5]. The REER is calculated from the nominal effective exchange rate (NEER) and a measure of the relative price or cost between the country under study and its trading partners. The most popular price and costs measures are consumer prices (CPI), producer prices (PPI), GDP deflator, unit labor costs (ULC) – see Chinn (2006) for a nice overview of the theoretical underpinnings of various REER measures. In this working paper we focus on CPI-based REERs. For the period 1960-2013, we find that the mean REER was 133.4 with a standard deviation of 641.3, and ranges between a minimum of 0.383 and a maximum of 56301.8. Moreover, Figure 1 suggests that the median value of the Log RER density equals 4.5, which is equivalent to REER= 88. Comparing the mean to the median values suggests that there are more depreciated extreme values than appreciated ones.

For robustness consideration, in addition to the Bruegel REER data set, we also construct another measure of the real exchange rate, given by RER (=XRAT/PPP), which is the ratio of the nominal

[5] For access to the data and a full description, see http://www.bruegel.org/publications/publication-detail/publication/716-real-effective-exchange-rates-for-178-countries-a-new-database/. Also see Darvas (2012).

exchange rate and the PPP conversion factors from Penn World Tables 7.1[6]. In turn, we use this RER measure to construct an index of the real exchange rate undervaluation (RERunderval). This index is calculated according to the methodology of Rodrik (2008), which adjusts the measured real exchange rate (RER) to the Balassa-Samuelson effect through the following regression:

$\ln RER_{it} = \alpha + \beta \ln RGDPCH_{it} + f_t + \mu_{it}$,

Where RGDPCH is real GDP per capita (international $ in 2005 constant prices, chain series). Following Rodrik (2008), we estimate the above equation for a panel of 1509 5-year time periods from 1950-54 to 2005-07. We estimate $\hat{\beta}$ = -0.24 at a very high significance level (with a t-statistic at 21.3). Though we use a recently revised and extended Penn World Table (PWT) data set, our estimates are very close to that of Rodrik (2008), which suggests that the Balassa-Samuelson effect is very strongly corroborated by the data. Using the predicted $\ln RER_{it}$ ($\ln \widetilde{RER}_{it}$) from the above equation, the log of RERunderval is simply derived as the difference between the actual and predicted log RER:

$\ln RERunderval_{it} = \ln RER_{it} - \ln \widetilde{RER}_{it}$

This simple, but intuitive, index is comparable across country and time[7], where ln RERunderval > 0 indicates that the currency is undervalued relative to purchasing-power parity (adjusted for the level of development). On the other hand, when ln RERunderval is negative the implication is that the exchange rate is set such that goods produced in the domestic economy are more expensive than warranted by PPP, hence the RER is overvalued. It is perhaps pertinent to note that the RER undervaluation index produced by this approach is based on price comparisons and is more basic than the model-based approach that accounts for the non-traded goods equilibrium and the inter-temporal external balance of an economy[8]. However, the former is more intuitive and easier to compute for literally all countries in the globe because of its minimal data requirements. Moreover, this undervaluation index was found to be robustly associated with growth, and hence should have a strong *indirect* effect on poverty through the growth channel, though this should have no bearing on whether or not it will also have a *direct* effect on poverty.

The distribution of the ln RERunderval index (Figure 2) suggests that the RER in the median country during the poverty spells is likely to be close to its notional Balassa-Samuelson equilibrium (i.e., ln RERunderval=0). However, there were also extreme cross-country differences in terms of the real exchange rate outcomes: for example, the Kyrgyz Republic experienced a maximum annual average RER undervaluation of 125%; compared to a maximum RER overvaluation of -99% for Yemen.

2.3 The Egyptian Household Income, Expenditure, and Consumption Survey (HIECS)

The Household Income, Expenditure and Consumption Survey (HIECS) is one of the most important household surveys around the world. This survey provides a rich set of data on living standards of households and individuals, which allows the construction of poverty indicators, designing social assistance programs, and providing necessary weights for compiling consumer

[6] PWT 7.1: Penn World Table: the Center for International Comparisons at the University of Pennsylvania (https://pwt.sas.upenn.edu/php_site/pwt71/pwt71_form.php).

[7] Johnson, Ostry, and Subramanian (2007) a cross sectional version of equation 1 for each year. However, the Rodrik (2008) approach is preferable because it allows consistent comparisons across time as well.

[8] See, for example, Aguirre and Calderon (2005), Razin and Collins (1997), Elbadawi (1994), Elbadawi and Soto (2008) and Elbadawi, Kaltani and Soto (2008), among others.

price indices. Egypt's first Survey that covered all the country's governorates was carried out in 1958/1959 followed by a series of similar surveys, the last one of which was the HIECS 2012/2013, which is the eleventh in this long series[9]. For the analysis of this paper, we use the most recent five HIECS: 1999/2000, 2004/ 2005, 2008/ 2009, 2010/ 2011 and 2012/ 2013. The 1999/2000 survey was conducted on a sample of 48000 households distributed between urban and rural areas, with 60% urban and 40% rural; while in the most recent survey of 2012/2013 a sample of 24,863 households was covered, 45.4% of which were urban. However, we only have access to a subset of this data from the ERF databank (Table 2).

Income data in HIECS consists of five sources of income that sum up to the final total disposable income, which suggests that wages and salaries account for more than 40% of HH disposable income; followed by self-employed income, with a share of more than 30%; and transfers, which account for close to 15% of total disposable income (Table 3.1). A similar pattern also exists regarding the income shares of the poor and the rich (Table 3.2 and 3.3), though as expected the income share of wages and salaries is larger for the case of the poor, while transfers, which might be dominated by remittances by HH members working abroad, attains a larger share for the case of the non-poor.

Finally, the distribution of income between the poor and non-poor makes clear that the poor are substantially deprived in Egypt. Though, according to the most recent HIECS 2012/2013 survey, they account for more than 26% of the population; their share in total disposable income (at 11%) was much lower than half their share of the population. Moreover, for transfers and property incomes their shares were only 8 and 3%, respectively (Table 4).

2.4 The dynamics of poverty and the RER over the HIECS cycle

The spread of poverty in Egypt (as measured by the headcount ratio) has been lower than the global ratio. However, it was steadily rising, while global poverty started to decline. By 2013 the two divergent paths eventually led to a global poverty ratio of only 10%, while the Egyptian poverty headcount ratio reached more than 25% (Figure 3).

As the received literature makes clear, the spread of poverty is influenced by much more than the RER. However, controlling for country fixed-effects, income per capita and income inequality we find robust negative association between the headcount ratio and RER depreciation in the global data (Figure 4). Moreover, the widening spread of poverty in Egypt also seems to be associated with an appreciating RER trend as well as overvalued real currency since 2010 (Figures 5 and 6).

As preliminary as it may be, this preliminary assessment suggests two pivotal conclusions: first, that the rise in the spread of poverty should be a major concerns and constitutes an anomaly to the declining global trend in poverty; and, second, that the recent RER appreciation in Egypt might be a factor contributing to the worsening poverty conditions in this country.

3. The Model

We present in this section a fully optimizing model that interfaces a version of the standard general equilibrium trade model (ala for example, Dixit and Norman, 1980; Woodland, 1982) with household production models, such as those of Benjamin (1992) and Singh et al. (1985). In the context of this model, we analyze the combined optimizing decisions of members of household (HH) as consumers and suppliers of labor and inputs to firms; and, in turn, the profit maximizing

[9] HIECS data were obtained through the ERF data portal with the households and individual data and distributed across the period of 1999-2012 as in the below table.

behavior of firms[10]. As we will show below, the emerging hybrid model allows assessing the potential impact of real exchange rate as an economy-wide relative price on household incomes and poverty. In particular, we assess the extent to which real exchange rate promotes pro-poor growth. We do this by measuring the net effect of real exchange rate depreciation/undervaluation on the income of the poor relative to that of the non-poor.

3.1 The households

We start off by positing the utility function, μ^h, for a representative household h:

$$\mu^h = \mu^h(c^h, l^h, Z^h) \tag{1}$$

Where c^h is an k-vector of consumer goods[11], l^h is leisure consumption, and Z^h is a vector of household attributes that influence consumption and time allocation decisions by members of the household (e.g., age, level of education, size of HH, demographic composition and location of the HH, etc.).

The budget constraint facing the HH is given by:

$$\sum_{j=1}^{k} p_j c_j^h \leq y^h , \tag{2}$$

Where p_j is the price of good j and y^h is the income of household h.

We assume that the Egyptian households participate in three major production activities: formal and informal sector as providers of wage labor; own-production, as producers of tradable intermediate goods, such as agricultural produce; and own-production, as producers of services and other non-tradable goods. Therefore, the HH income is composed of wage income (y_w); income from own businesses, producing tradable inputs of goods and services (y_{TI}); and, income from own businesses, producing non-tradable inputs of goods and services (y_{NI}). Moreover, some households also receive other income in terms of transfers: remittances from HH members working abroad or in terms of rents from real estate properties, etc. (y_o). Thus, the aggregate real HH income is given by:

$$y^h = y_w^h + y_{TI}^h + y_{NI}^h + y_o^h \tag{3}$$

And,

$$y_w^h = wL_w^h \tag{3.1}$$

$$y_{TI}^h = p_{TI} q_{TI}^h (L_{TI}^h, e : Z^h) \tag{3.2}$$

$$y_{NI}^h = p_{NI} q_{NI}^h (L_{NI}^h, e : Z^h) \tag{3.3}$$

$$y_o^h = y_o^h (e : Z^h) \tag{3.4}$$

Where $L_w^h, L_{TI}^h, L_{NI}^h$, respectively, denote the number of labor units allocated by the HH to labor, own production of tradables and non-tradable inputs; q_{TI}^h and q_{NI}^h are the amounts of the composite tradable and non-tradable goods produced by the household h and sold as inputs to manufacturing

[10] Our model is closest to Porto's (2005), though he was only interested on the links of agricultural HH to industry.

[11] The consumer goods could include home-produced goods, such as food produced by the agricultural HH.

firm (see below); p_{TI} and p_{NI} are the corresponding prices for the composite tradable and non-tradable goods; and, e is the real exchange rate (i.e., e =RER), which is the economy-wide relative price that influence households and firms inter-sectoral labor and investment allocation decisions. All prices are defined as relative to the aggregate price level p, given by the CPI.

Equations 3.2 and 3.3 suggest that, controlling for HH characteristics, the supply functions of tradable and non-tradable goods are influenced by labor allocated to the activity in question and the real exchange rate, which is taken to be a proxy for relative prices of tradables. Finally, other HH income, y_o^h, is assumed to be directly influenced by the real exchange rate, given HH characteristics. Real exchange rate depreciation (an increase in e) is likely to promote the production of tradables and discourage non-tradables; while it will increase the real domestic currency value of other income, should it be dominated by foreign currency-denominated remittances. Instead, it should be negatively impacted if dominated by local currency-denominated transfers.

Now, substituting equations (3), (3.1)-(3.4) into equation (2), we have:

$$\sum_{j=1}^{k} p_j c_j^h \le wL_w^h + p_{TI} q_{TI}^h (L_{TI}^h, e : Z^h) + p_{NI} q_{NI}^h (L_{NI}^h, e : Z^h) + pY_o^h (e : Z^h) \tag{4}$$

HH utility maximization (equation 1) subject to the above constraint allows the derivation of HH labor supply, supply of tradable and non-tradable goods and services, some of which used as inputs for industry; and, demand functions for consumer goods.

3.2 The firms

We assume that firms are specialized in the production of tradable goods and services, which are composed of exportable and importable goods alike. Aside from the public sector, non-tradable goods and services are assumed to be produced by the households in the informal markets. However, firms procure tradable as well as non-tradable goods and services (Q_T, Q_N) as inputs, and hire labor L_m in order to produce manufacturing and other processed goods. Hence, firm profit is given by:

$$\pi_m = e.q_m^h (L_m, Q_{TI}, Q_{NI}; \varphi_m, \varphi_{pub}) - wL_m - p_{TI} Q_{TI} - p_{NI} Q_{NI} \tag{5}$$

Where φ_m is a vector of firm's specific technological parameters and φ_{pub} is a set of exogenous factors associated with public policy or the overall macro economy, such as public sector wage, minimum wage, and rate of unemployment, etc.

Factor demand functions could be derived from the profit maximization of equation (5):

$$L_m = l_m (w, e, p_{TI}, p_{NI} : \varphi_m, \varphi_{pub}, P) \tag{6}$$

$$Q_{TI} = q_{TI} (w, e, p_{TI}, p_{NI} : \varphi_m, \varphi_{pub}, P) \tag{7}$$

$$Q_{NI} = q_{NI} (w, e, p_{TI}, p_{NI} : \varphi_m, \varphi_{pub}, P) \tag{8}$$

Where P is a vector of the other goods consumed by the HH. By invoking goods and factors markets clearing conditions[12], we are able to derive the ultimate expressions for wage and input

[12] Since the model accounts for all exporting and import substituting firms, the labor market clearing condition requires that the supply of labor from all HHs must equal the demand for labor by all industries in the economy.

prices as functions of the economy-wide real exchange rate and other factors exogenous to the HH decision:

$$w = w(e : P, Z, \varphi_m, \varphi_{pub}) \tag{9}$$

$$p_{TI} = p_{TI}(e : P, Z, \varphi_m, \varphi_{pub}) \tag{10}$$

$$p_{NI} = p_{NI}(e : P, Z, \varphi_m, \varphi_{pub}) \tag{11}$$

3.3 The poverty impact of the real exchange rate

Solving for the demand for goods and the supply of labor and tradable and non-tradable inputs (equation 9-11) and plugging the solved out expressions into the budget constraint of equation (4), we have the following income-expenditure equality[13]:

$$\exp^h(e, P, \mu^h : Z^h) = wL_w^h + wL_{TI}^h + wL_{NI}^h + \pi_{TI}^h(p_{TI}) + \pi_{NI}^h(p_{NI}) + y_o^h(e) \tag{12}$$

The above equation states that changes in real the real income of the HH is accounted for by changes in consumer prices, wages, and non-wage income. The latter is comprised by profits from tradable and non-tradable goods and services produced by the HH (π_{TI}^h , π_{NI}^h); and, remittances and rental income from real estate and other properties, which we collect into other income (y_o^h). Total expenditure is given by the expenditure function: $\exp^h(\ldots)$. Using Shepherd Lemma ($\partial \exp^h / \partial e = c_m^h$) and Hotelling Lemma ($\partial \pi_S^h / \partial p_S = q_S^h$, and, $\partial \pi_S^h / \partial w = -L_S^h$, where s=TI, NI)[14], allows the derivation of the first order effect of a change in the real exchange rate on HH income[15]:

$$c_m^h de + \frac{\partial \exp^h}{\partial \mu^h} d\mu^h = (\frac{\partial w}{\partial e} L_w^h + q_{TI}^h \frac{\partial p_{TI}}{\partial e} + q_{NI}^h \frac{\partial p_{NI}}{\partial e} + \frac{\partial y_o}{\partial e}) de \tag{13}$$

Now dividing both sides by aggregate income, y, we have the following expression for the change in real income of household h:

$$dy^h = (s_w^h \varepsilon_{w,e} + s_{TI}^h \varepsilon_{TI,e} + s_{NI}^h \varepsilon_{NI,e} + s_{y_o}^h \varepsilon_{y_0,e}) d \log e \tag{14}$$

Where, s_w^h , s_{TI}^h , s_{NI}^h ,and $s_{y_o}^h$ are, respectively, the shares in total HH income[16] of wage income; cash incomes from producing tradable and non-tradable inputs; and the incomes from transfers, remittances and rental incomes; while $\varepsilon's$ are the corresponding elasticities with respect to the real exchange rate (e).

The above pivotal equation makes clear that HH income is *directly* influenced by the real exchange rate, which operates through its effects on prices of manufactured consumer goods, prices of tradable and non-tradable inputs supplied by the HH as well as non-wage income. Moreover,

[13] Strictly speaking, expenditure needs not be equal to income, however, the equality could still be assumed since a residual income term could be added to the equation.

[14] See, for example, Dixit and Norman (1980), Woodland (1982) and Singh et al. (1985).

[15] A shortcoming of the first order approximation is that it abstracts from second-order substitution effects. However, as pointed out by Porto (2005) this should not pose a problem for this type of model, because substitution responses would actually reinforce the direct effects captured in equation 13. This is because on the consumption side, consumers would substitute away from higher price-goods; and on the production side, increased supply would boost the demand for HH labor and HH income from tradable and non-tradable inputs.

[16] We use HH income and expenditure interchangeable to mean the same thing.

equation (14) allows asking the question as to whether RER depreciation/undervaluation is pro-poor. To test this hypothesis, let y_p and y_{np} be, respectively, the average income of the poor and non-poor, then real exchange rate deprecation/undervaluation is pro-poor provided that:

$$I_{p,np} = \frac{[\frac{\partial y_p}{\partial e}]}{[\frac{\partial y_{np}}{\partial e}]} - 1 > 0 \qquad (15)$$

However, the net impact of the RER depreciation/undervaluation on HH income or whether or not its direct income effect is pro-poor could not be signed a priori. Therefore, the empirical estimation of the elasticities of equation 14 attains a high premium for this research. We turn next to this when we estimate the determinants of HH wage and non-wage income using the five yearly episodes of the Egyptian HH surveys.

4. Estimating of Wage and non-Wage Incomes

We first lay out our econometric strategy for estimating the elsticities of the pivotal equation 14. To quantify the changes in wage and non-wage incomes of an RER depreciation or undervaluation policy engineered at the macroeconomic level of the economy, we need to estimate the structural parameters of equations (9)-(11), derived earlier in section 3 as functions of the RER and other factors exogenous to the HH, including relative prices of HH consumer goods, firm's specific technological parameters and a host of variables associated with public policy or overall economic conditions (e.g., public sector wage, minimum wage, and rate of unemployment, etc.). Using data from the five cycles of the Egyptian HH survey combined with time series data on the RER and other macroeconomic variables, we construct a large panel data that allows identifying the RER effects, while controlling for standard HH and individual in HH characteristics[17].

To estimate the elasticities of equation (14), we specify two equations for real wage and real non-wage income, where the latter is an aggregate measure of all non-wage incomes: income from HH profits as producer and supplier of tradable and non-tradable inputs; cash transfers; and rental incomes from real estate and other properties. Denoting the wage and non-wage incomes of individual i from household h at time by w_{iht} and y_{iht} ,respectively, we posit the following "generically" identical equations:

$$\log w_{iht} = \beta_0^w + \beta_1^w \log e_t + P_t^{'} \gamma^w + Z_{iht}^{w\,'} \delta^w + \eta_i + \eta_t + \upsilon_{iht}^w \qquad (16)$$

$$\log y_{iht} = \beta_0^y + \beta_1^y \log e_t + P_t^{'} \gamma^y + Z_{iht}^{y\,'} \delta^y + \eta_i + \eta_t + \upsilon_{iht}^y \qquad (17)$$

Where, as before, P is a vector of relative prices consumed by the HH member; Z is a vector of HH characteristics, some of which might be time-varying; η stands for time and HH member fixed effects; and, υ_{iht} is a random disturbance term. And, for the case of the wage equation we plan to estimate sector-specific regressions because the impact of the RER on wages is likely to differ according to the sector of employment of the HH member in question. For example, we expect an RER depreciation to boost demand for labor in the tradable sectors, hence possibly leading to a real wage increase. Instead, it is likely to hinder the expansion of non-tradable sectors (in terms of marginal impact), possibly causing real wages to decline in these sectors. Likewise, we also plan

[17] Unfortunately, however, the data available to us does not include the consumer prices faced by the HH.

to run separate regressions for each source of non-wage income, again because the RER might not have the same impact across the various non-wage income sources, depending on the extent of their tradability.

Subject to the other controls, our primary parameter estimates are $\hat{\beta}_1^w$ and $\hat{\beta}_1^y$. The estimated coefficients can be easily shown to identify the structural parameters of equations (9)-(11), when final tradable goods (manufacturing in our model) are competitively produced and under constant returns to scale production functions. In this case equilibrium prices must be equal to unit production costs. This means that prices of factors supplied by the HH (w, p_{TI}, p_{NI}) are exclusively determined by the relative price of the final traded goods, or the RER as an economy-wide relative price, dubbed as "factor price insensitivity" theorem (Feenstra, 2004)[18]. However, Porto (2005) argues that identification need not require such restrictive assumptions and that under standard downward sloping factor demand curves, structural parameters could be identified, provided that we control for measures or proxies of factor supplies in wage and non-wage income equations, such as those of equations (16) and (17) above[19].

We estimate the above two equations by panel fixed-effect regressions, using the HIECS five rounds of 1999/2000, 2004/ 2005, 2008/ 2009, 2010/ 2011 and 2012/ 2013. The panel data set over all members of HH in the five rounds of the survey sums up to 497,262 observations. The regressions results are collected in Tables 5-8. The regression results were all highly significant at the 99% significance level.

The dependent variables of the regression are mainly divided into two income categories: the first one is wages and salaries income and the second is aggregate non-wage income. Starting with the wage equation, we first estimate 10 sector-specific regressions and find that, depending on the significance and sign of log RER elasticities [20] (or the corresponding ones for the RERunderval, which we use as a 'normative' alternative measure of RER competitiveness), the ten sectors could be integrated into the following three main groups:

- Group 1: agriculture and fishing, transportation, storage and communication and financial, insurance and real estate, where each sector-specific regression produced positive and significant RER (as well as RERunderval) elasticity;
- Group 2: manufacturing, mining, commerce and public administration, where each sector-specific regression produced insignificant RER (as well as RERunderval) elasticity; and
- Group 3: utilities, construction and other services, where each sector-specific regression produced negative and significant RER (as well as RERunderval) elasticity.

Based on these preliminary results (not reported) we ran regressions for the three groups to estimate the RER elasticities, while controlling for standard HH characteristics (Table 5); and similarly we ran corresponding regressions for estimating the RERunderval elasticities (Table 7). For all six regressions we find robust and highly significant RER effects. The results suggest that RER depreciation/undervaluation promotes wage incomes for those employed in the sectors of Group 1; depresses wages in the sectors of Group 3; while it has no effect for the sectors of Group 2. While the sectors of Group 3 are clearly of non-tradable nature, hence the results seems quite plausible; the sectoral composition of the other two groups is rather mixed, which suggests that

[18] However, this implies horizontal factor demands curves, which shift up or down by the changes in the real exchange rate and the technology parameters.

[19] However, unfortunately, no such data on these variables exists in the HIECH data base for Egypt.

[20] The RER was scaled to the first year in the data 1999 to be the base year as well as the CPI values to convert all incomes and expenditures into real values.

the effect of the RER on wages is not necessarily strictly driven by the tradability of the sectors in question. The estimated RER and RERunderval eslasticities are generally comparable, respectively, equaling 0.25 and 0.22 for Group 1; and -0.26 and -0.30 for Group 3.

Next we discuss the evidence on the RER elasticities for the case of non-wage income, which is comprised by four income sources: self-employed income in agricultural sector; self-employed income in non-agricultural sector; rental and property income; and, transfers. The regressions corresponding to RER and RERunderval are reported in Tables 6 and 8, respectively. Except for the agricultural non-wage income for the case of the RER regressions, we find the models with non-monotonic RER and RERunderval effects to produce more plausible results. Moreover, the non-monotonic regressions appear to be statistically well founded, given the highly statistically significant coefficients of the log RER squared and RERunderval squared. For the RER regressions (Table 6), the estimated RER elasticity for agricultural non-wage income was negative but non-monotonic, while for the other three non-wage income sources the estimated elasticities were all positive and non-monotonic. Instead, for the RERunderval regressions (Table 8), the estimated elasticities were positive but non-monotonic for agricultural, non-agricultural and rents incomes; while for transfers the corresponding elasticity was negative and non-monotonic.

Subscribing to the main objectives of this paper, the discussion of the estimation results has been focused on the log RER and RERunderval effects. However, the marginal impact of the real exchange rate variables is estimated conditional on a robust set of standard HH characteristics contained in the HIECS data base, including urban/rural residence, age in years, gender, marital status, educational attainment, employment status, sector of employment, type of dwelling, access to electricity, running water and toilet facility. Like the real exchange rate, most of the controls have highly significant and plausible effects on the wage and non-wage incomes. For example, compared to rural areas, urban governorates in Egypt are likely to be associated with higher wages and salaries. This is consistent with the fact that poverty in Egypt has been concentrated in the rural areas, where the headcount index in urban Upper Egypt was estimated at about 27%, compared to almost 50% in rural Upper Egypt (CAPMAS 2012-2013). Also, individuals with better educational attainment are more likely to receive higher wages and salaries than those with less or no education. This also agrees with the received evidence, where the spread of poverty among illiterate individuals in 2013 was staggering at 37%, compared to only 9% and 4% among those with university or above university degrees (CAPMAS 2012-2013).

5. The Poverty Impact of Real Exchange Rate

The econometric results make clear that depreciated or mildly undervalued real exchange rates have an overall positive marginal impact on wage and non-wage incomes. However, assessing whether or not such strategy is pro-poor requires evaluating the pro-poor metric of equation (15), using the estimated elasticities and showing that it is satisfied for a robust set of estimates. We reckon that making such a calculation requires access to more detailed data at the HH level on the composition of the sectoral breakdown of wage incomes and on the sources of non-wage incomes. For example, it is not clear whether the “transfers” as a source of non-wage incomes is dominated by the tradable and foreign currency denominated remittances from members of the household working abroad, or, instead, it is mainly reflecting the contribution of transfers from social funds and public sector anti-poverty programs. While the former is likely to be positively associated with depreciated or undervalued RER, the latter will likely be negatively affected by such real exchange rate policy. Moreover, as discussed in section three, we would need more data at the HH level to better identify the structural parameters of equation (14) from the reduced-form wage and non-wage income regressions of section four.

Due to the above considerations we use illustrative estimates of the aggregate wage and non-wage income elasticities with respect to the change in log RER ($\Delta \log RER$) to test the pro-poor hypothesis. The estimated elasticities are obtained from the regressions of Table 9. As for the case of the disaggregated income elasticities we find the log RER effect to be positively but non-monotonically associated with aggregate non-wage income. However, unlike the results for the disaggregated wage income, where only level effects obtain, for the aggregate wage income we find highly significant positive but also non-monotonic log RER effect. Using these estimates we construct the estimated version of equation (14) for the response of net wage and non-wage incomes of the poor and the non-poor to the change in Log RER:

Poor members of the HH in the sample: [{(20.03 -2 (2.079). Log RER)}. 45.8%] + [{(3.429 - 2(0.377). Log RER)}.54.2%] $\Delta \log RER$ (18)

Non-Poor members of the HH in the sample: [{(20.03 -2(2.079). Log RER)}.42.1%] + [{(3.429 - 2(0.377). Log RER)}.57.9%] $\Delta \log RER$ (19)

Where the percentage shares are obtained from Tables 3.2 and 3.3 of section 2. Figure 7 simulate the above two response curves for $\Delta \log RER$, ranging from a high appreciation of 10% (i.e. $\Delta \log RER$ *100%= -10%) to a large depreciation close to 20% (i.e. $\Delta \log RER$ *100%= 20%). These two values reflect the extreme percentage changes actually experienced by the Egyptian real exchange rate during the 1990-2013 period, which covers the five HIECS survey rounds. According to the figure, the response of the net income of the poor was consistently lower in the appreciation phase, suggesting that RER appreciation produces anti-poor growth; while growth was neutral when the RER remains stationary. Instead, RER depreciation by close to or more than 10% promotes relatively large and robust pro-poor growth. Therefore, we are able to generate strong, albeit rather preliminary and highly aggregative, evidence supporting the pro-poor hypothesis of an RER depreciation/undervaluation[21] strategy, which attests to the view that it is a potentially viable economy-wide policy instrument for fighting poverty.

6. Conclusions

This paper is motivated by the fact that despite the presence of a growing literature on the viability of an RER-led growth and economic diversification strategy, there is surprisingly very little research on the *direct* potential poverty reducing impact of such a strategy, beyond its *indirect* effect through the growth channel. In particular, the received literature does not specifically analyze the impact of RER undervaluation, which needs to be distinguished from RER depreciation. This is because the former measures the RER depreciation relative to a "notional" equilibrium; hence, it entails a "normative" concept of a deliberate development strategy as discussed in the growth and economic diversification literature.

Therefore, we attempt to fill this lacuna by developing a theoretical model that explicitly analyzed the poverty impact of the RER, as an economy-wide relative price, in a fully optimizing model at the household and the firm levels. The model allows empirical estimation of the response of average household (HH) wage and non-wage income to RER depreciation /undervaluation. In particular, it is possible to assess the extent to which an RER undervaluation (or an RER depreciation) is pro-poor, using a precise metric that compares the rate of change of the income of the poor relative to that of the non-poor in response to RER devaluation/depreciation.

[21] We use depreciation and undervaluation strategy interchangeable here, because the two concepts are linearly related. However, in a revised version of the paper we plan to undertake similar simulation relative to the rate of RER undervaluation as well.

We estimate this model using national-level panel data from the Egyptian Central Agency for Public Mobilization and Statistics and the ERF's data bank. We assess the evidence at the detailed HH level, which allows accounting for HH level controls and testing for a much richer set of hypotheses than could be had when using global country panel data. From the perspective of real exchange rate, the evidence gleaned from the estimation of the HH wage and non-wage incomes can be synthesized into four main conclusions.

First, overall, strategic real currency depreciation/undervaluation, at the macroeconomic level leads to higher wages and other non-wage income. By raising incomes at the HH level, including those of the poor, such a strategy is likely to be good for the poor.

Second, this strategy is actually pro-poor, because the marginal impact on the income of the poor is higher than that of the non-poor.

Third, however, an RER depreciation/ undervaluation exchange rate policy has differentiated effects on wages across economic sectors; and on different non-wage incomes. For example, those employed in the non-tradable sectors or those receiving transfers from social funds are likely to be negatively impacted by such policies.

Fourth, while the received growth literature suggests that RER undervaluation and growth are positively associated for a large range of RER undervaluation, the non-monotonic effects of the RER undervaluation poverty impact suggests that beyond a certain threshold, further RER undervaluation might actually worsen rather than reduce poverty. Hence, only mild RER undervaluation is likely to be good for poverty.

Despite that we have argued that this paper makes a novel contribution to the literature, nonetheless we regard this research as work in progress. Though we are able to glean highly policy-relevant evidence on the effectiveness of an RER depreciation/undervaluation policy as a pro-poor growth strategy, we still need to develop a better understanding of the channels through which RER undervaluation might influence poverty. This would require access to more detailed data from the HIECS- type HH and other labor surveys. Also, as discussed in section three, identifying the "true" structural parameters of the model requires accounting for the relative prices of the HH consumption demand as well as the labor and other input supply data. However, this data is not yet available to us, though it might be available in the more extended versions of the HIECS data base. In addition, a more compelling statement about the pro-poverty impact of real exchange rate undervaluation strategy requires testing the pro-poor metric with a robust set of estimates of the RER elasticities of wage and non-wage incomes. In turn, this requires at least two, maybe three, different measures of RER undervaluation and fairly disaggregated income categories at the household level.

Furthermore, having argued for RER undervaluation as a much needed poverty reduction strategy, a central question would be how governments in developing countries, such as Egypt might engineer RER undervaluation episodes? and second, what are the channels that are likely to be most important for generating the desired RER impact on poverty? These issues should be the subject of further in-depth research in the future.

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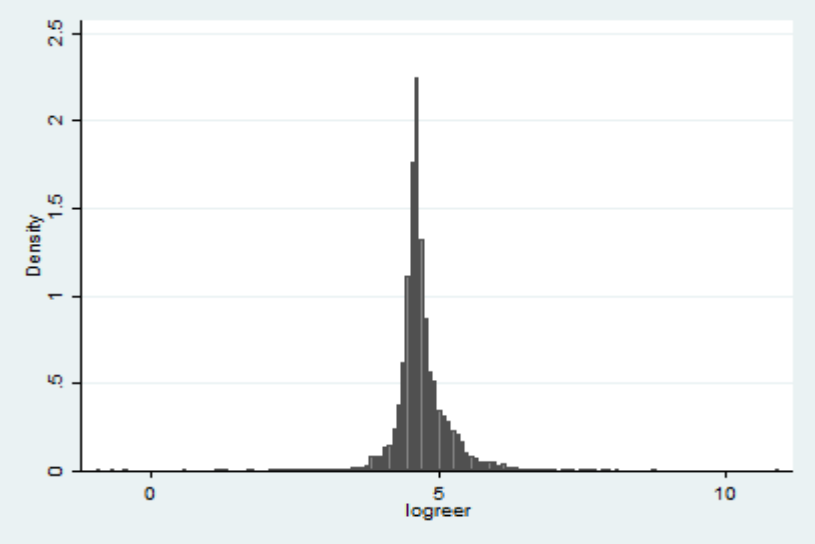
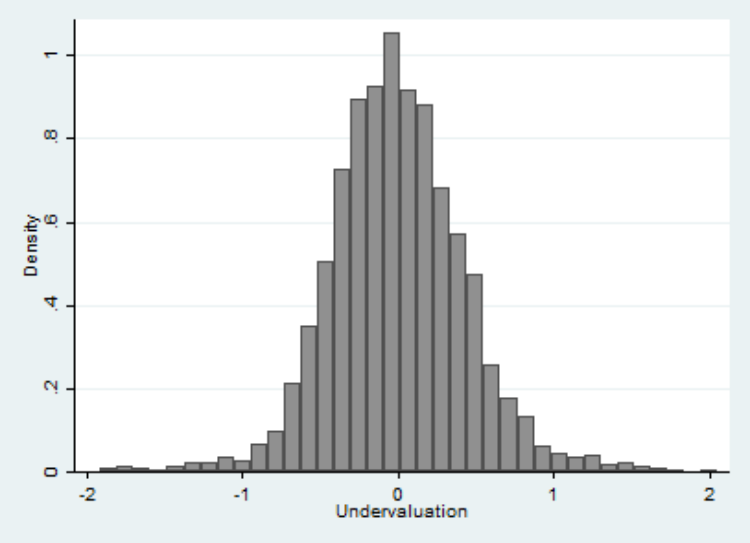
Figure 1: Log REER Histogram



Notes: Authors' elaboration, using the REER Bruegel data base.

Figure 2: Log RER Undervaluation Histogram



Notes: the distribution is based on the RERunderval index, generated from the Rodrik-type regression.

Figure 3: The Dynamics of Egyptian and Global Poverty

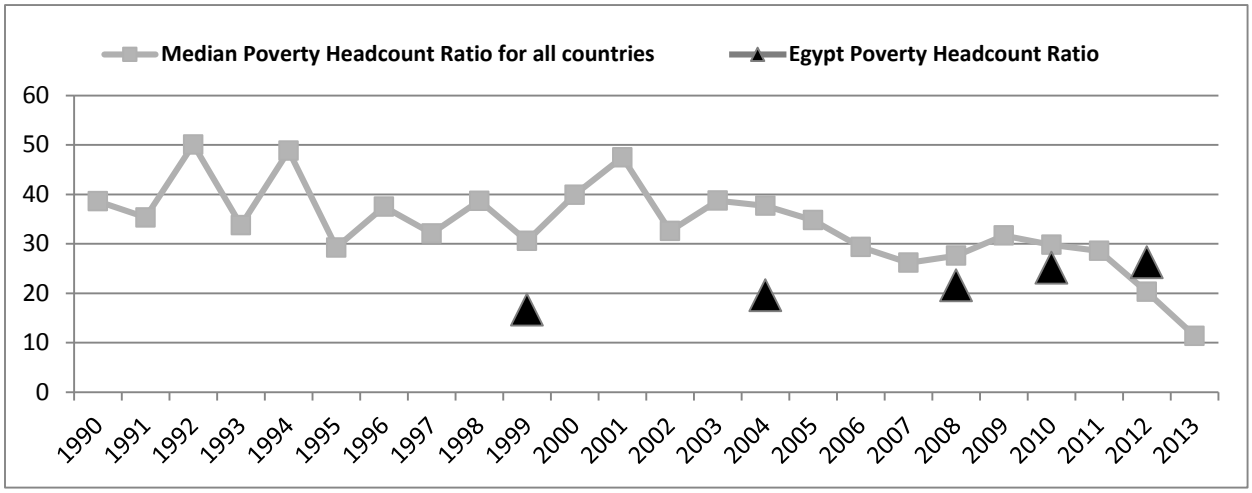
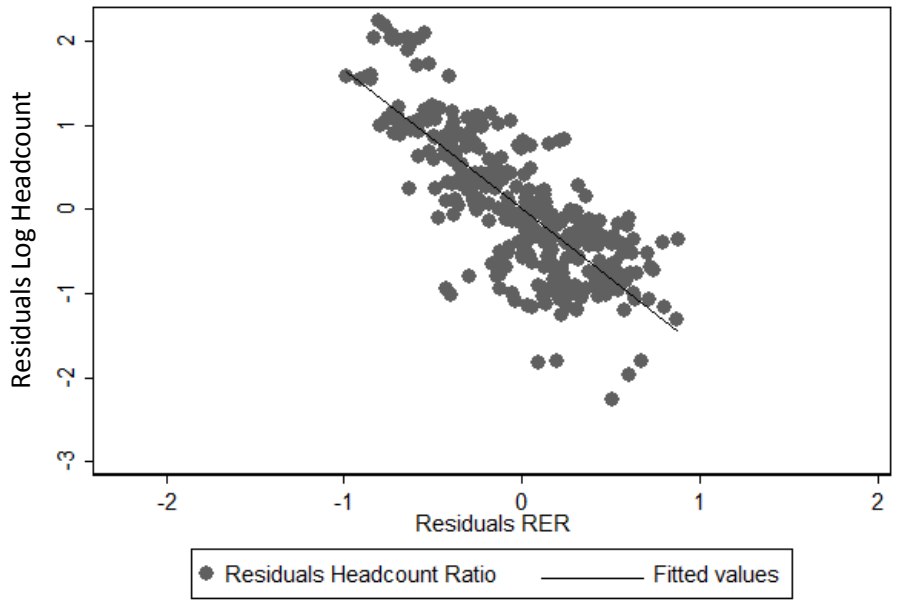


Figure 4: The Global Poverty Headcount and the RER



Notes: the scatter is based on the residuals from log H and log RER of the following two regressions: Regression equation for the headcount:Log(H) = 7.56 – 0.3296 Log(Consumption) + 0.958 Log(Gini) Regression equation for RER: Log(H) = 2.79 + 0.0267 Log(Consumption) + 0.3113 Log(Gini).

Figure 5: Spread of Poverty and the Real Exchange Rate in Egypt

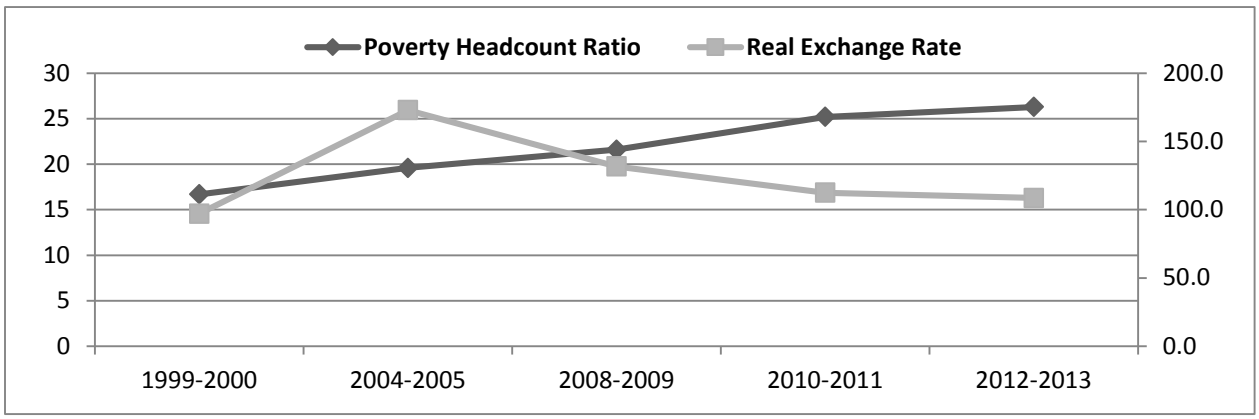


Figure 6: Spread of Poverty and the Real Exchange Rate Undervaluation in Egypt

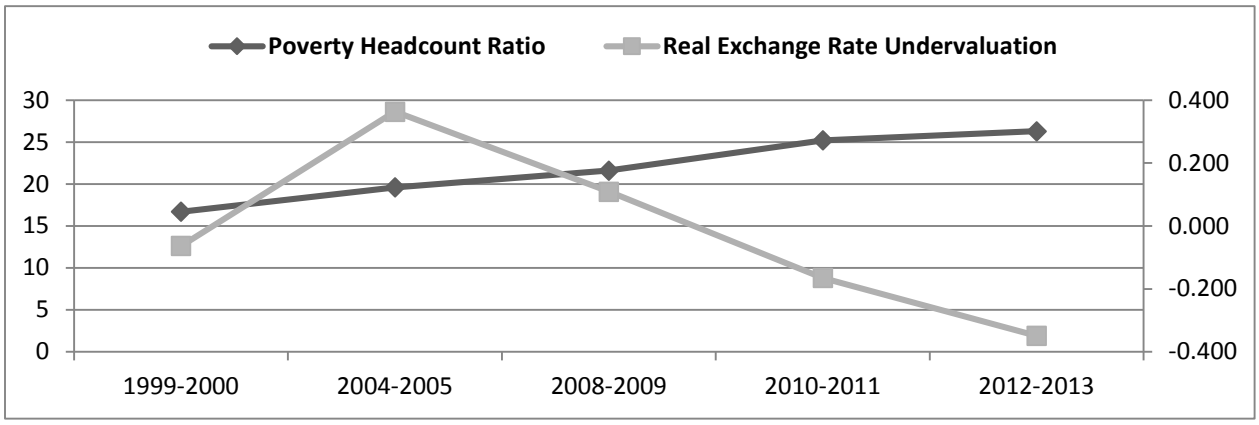


Figure 7: Responses of Incomes of the Poor and Non-poor to RER Depreciation

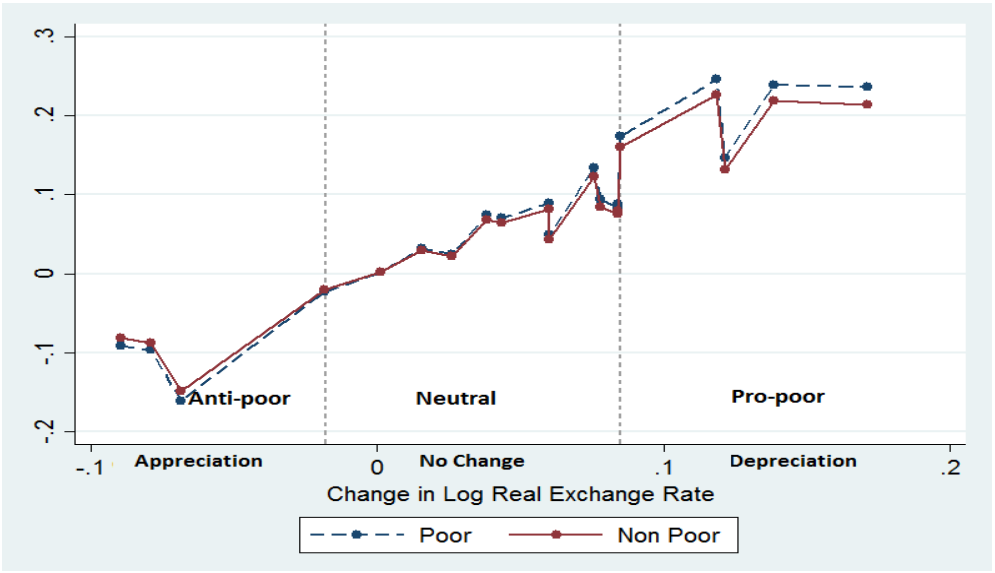


Table 1: Global Poverty and Correlates

	Global Median 2000	Global Median 2011	Egypt 2000	Egypt 2011
poverty	40	29	17	25
HH conspc	1198	3313	1145	1560
Gini index	36	38	33	31
gdppc_ppp_kusd	2050	4804	1510	2157

Source: World Bank's WDI data base.

Table 2: Number of Households from HIECS Survey Modules Used in the Analysis

Survey Year	Number of Households
1999/ 2000	23,975
2004/ 2005	47,095
2008/ 2009	23,428
2010/ 2011	7,719
2012/ 2013	7,528
Total	**109,745**

Table 3.1: Sources of HH Disposable Income in Egypt

Year	Net Wages and Salaries (%)	Self Employed Income (%)	Rentals (%)	Property Income (%)	Transfers Received (%)	Total Disposable Income (%)
1999	40.7	32.5	0.0	11.2	15.3	100.0
2004	42.4	32.4	8.1	3.7	13.6	100.0
2008	41.8	30.4	9.9	3.5	14.5	100.0
2010	43.2	27.5	10.6	3.0	16.0	100.0
2012	45.1	25.8	10.2	2.6	16.2	100.0
Average	**42.3**	**30.4**	**7.8**	**4.6**	**14.6**	**100.0**

Notes:

1. Net wages and salaries, consists of cash wage and salary income (including employer bonuses, 13th month bonus, etc.), net of employer and employee social insurance contributions and taxes. This item represents 42.3% of the total disposable income.
2. Self-employed income, represents profit/loss from unincorporated enterprises. The income is recorded gross of social insurance contributions (but net of expenses), representing a share of 30.4% of the total disposable income.
3. Rentals, represents rentals from dwellings, business buildings, vehicles, equipment, etc. excludes rent from land
4. Property income, interest received less interest paid Dividends Rent from land
5. Transfers received , consists of social insurance, assistance, inter-household transfers, regular support received such as charities, disability pensions, allowances, benefits etc. Child/family benefits.

Table 3.2: Poor Income Shares

Year	Net Wages and Salaries (%)	Self Employed Income (%)	Rentals (%)	Property Income (%)	Transfers Received (%)	Total Disposable Income (%)
1999	41.9	40.4	0.0	6.7	11.2	100.0
2004	43.2	37.9	8.9	0.7	9.2	100.0
2008	46.6	32.6	9.6	0.7	10.6	100.0
2010	48.0	29.9	10.1	0.7	11.2	100.0
2012	49.1	27.8	10.1	0.5	12.4	100.0
Total	**45.8**	**33.7**	**8.7**	**1.2**	**10.6**	**100.0**

Table 3.3: Non-Poor Income Shares

Year	Net Wages and Salaries (%)	Self Employed Income (%)	Rentals (%)	Property Income (%)	Transfers Received (%)	Total Disposable Income (%)
1999	40.8	32.1	0.0	11.6	15.6	100.0
2004	42.3	31.8	8.0	4.0	14.0	100.0
2008	41.0	30.0	10.0	3.9	15.0	100.0
2010	42.4	27.0	10.7	3.3	16.6	100.0
2012	44.5	25.5	10.3	2.9	16.9	100.0
Total	**42.1**	**30.2**	**7.7**	**5.0**	**15.2**	**100.0**

Table 4: Income Shares among Poor and Non-Poor

	Net Wages and Salaries (%)	Self Employed Income (%)	Rentals (%)	Property Income (%)	Transfers Received (%)	Total Disposable Income (%)
Poor	11	12	12	3	8	11
Non-Poor	89	88	88	97	92	89
	100	**100**	**100**	**100**	**100**	**100**

Table 5: Fixed Effect Regression Results for the Wages and Salaries by Industry Groups

Wages and Salaries	GROUP 1		GROUP 2		GROUP 3	
Real exchange rate	0.247	***	-0.001		-0.261	***
Urban/Rural Residence (Urban)	-0.372	***	0.424	***	0.056	**
Age in years	0.004	***	0.003	***	-0.002	***
Gender (Females)	0.199	***	-0.546	***	0.424	***
Marital status						
Married monogamous	0.169	***	-0.111	***	-0.081	***
Married polygamous	0.450	**	-0.193		-0.334	
Divorced/separated	-0.225	***	-0.018		0.133	*
Widowed	-0.088	**	-0.047		0.036	
Not stated	0.382		-0.550		0.219	
Educational level						
Primary/lower secondary	-0.111	***	0.162	***	0.007	
Secondary	-0.161	***	0.099	***	0.123	***
Post-secondary or equivalent	-0.313	***	-0.552	***	0.975	***
University	-0.167	***	-0.773	***	1.182	***
Postgraduate	-0.526	***	-2.177	***	3.381	***
Status of Employment						
Employee	2.742	***	4.239	***	2.364	***
Employer	4.987	***	3.509	***	0.520	**
Own-account, self-employed	5.182	***	3.926	***	0.005	
Contributing (unpaid) family worker	6.438	***	3.087	***	-0.424	*
Not stated	2.479	***	4.383	***	2.305	***
Sector of Employment						
Government	-1.995	***	-0.518	**	1.927	***
Public sector	-0.650	***	0.407		-0.114	
Private sector	-0.246		-0.423	*	0.090	
Joint/cooperative	0.719	**	-0.508		-0.767	**
Other	1.836	***	-3.622	***	1.123	
Type of Dwelling						
Villa	0.008		0.031		0.146	
Apartment	-0.145	***	0.238	***	-0.042	
Others	-0.234	***	-0.003		0.217	***
Room	0.036	***	0.003		-0.007	
Electrified (Yes)						
Water Facilities	-0.104		0.233		-0.054	
Public tap	0.067		0.019		-0.093	**
Well	0.294	***	-0.133	***	-0.260	***
Other	0.272	**	-0.048		-0.232	**
Toilet facility						
Yes and not connected to sewage	-0.040	*	-0.118	***	0.071	***
No facility	-0.018		-0.126		0.116	
Year	-0.052	***	0.045	***	0.010	***
Constant	103.774	***	-90.459	***	-18.832	***

Table 6: Fixed Effect Regression Results for the Non-Wages Income Groups

Non Wages Income	Agriculture		Agriculture (Level)		Non-agriculture		Rentals		Transfers	
Real exchange rate	-9.056	***	0.239	***	83.794	***	7.331	***	28.306	***
RER Squared	0.949	***	-		-8.597	***	-0.732	***	-2.976	***
Urban/Rural Residence (Urban)	-0.651	***	-0.653	***	-1.024	***	-1.573	***	0.349	***
Age in years	0.006	***	0.006	***	-0.004	***	0.000		0.053	***
Gender (Females)	0.798	***	0.798	***	0.279	***	-0.038	***	0.055	***
Marital status										
Married monogamous	-0.034	***	-0.034	***	0.297	***	0.007		-1.577	***
Married polygamous	0.136		0.135		0.274	*	0.073		-1.816	***
Divorced/separated	-0.473	***	-0.472	***	-0.649	***	-0.257	***	0.527	***
Widowed	-0.342	***	-0.342	***	-0.657	***	-0.012		-0.168	***
Not stated	-0.91		-0.894		1.103		1.667		0.683	
Educational level										
Primary/lower secondary	-0.29	***	-0.290	***	-0.179	***	-0.038	**	0.117	***
Secondary	-0.216	***	-0.216	***	-0.319	***	0.075	***	0.142	***
Post-secondary or equivalent	-0.324	***	-0.325	***	-0.501	***	0.033		0.191	***
University	-0.38	***	-0.381	***	-0.582	***	0.31	***	0.163	***
Postgraduate	-0.269	***	-0.270	***	-0.512	***	0.959	***	0.13	
Status of Employment										
Employee	0.85	***	0.853	***	-0.46	**	0.146		-0.766	***
Employer	4.872	***	4.877	***	3.934		0.497	***	-1.504	***
Own-account, self-employed	3.333	***	3.337	***	2.893		0.52	***	-0.827	***
Contributing (unpaid) family worker	6.065	***	6.069	***	2.101		0.445	***	-1.094	***
Not stated	0.804	***	0.810	***	-0.274		0.143		0.194	
Sector of Employment										
Government	-0.403	***	-0.406	***	0.503		-0.229		-0.184	
Public sector	-0.237		-0.241		-0.105		-0.254		-0.315	
Private sector	-0.098		-0.100		0.113		-0.434	***	0.306	
Joint/cooperative	1.269	***	1.263	***	0.429		-0.208		-0.226	
Other	1.746	***	1.739	***	0.115		-0.406	**	0.654	***
Type of Dwelling										
Villa	-0.427	***	-0.421	***	-0.376	***	1.297	***	-0.166	
Apartment	-0.305	***	-0.305	***	-0.328	***	-0.106	***	-0.102	***
Others	-0.195	***	-0.197	***	-0.209	***	-0.478	***	0.43	***
Room	0.096	***	0.095	***	0.392	***	0.364	***	0.071	***
Electrified (Yes)	0.096		0.096		0.603	***	0.168	**	-0.223	**
Water Facilities										
Public tap	0.03		0.032		0.039		0.053	**	0.041	
Well	0.348	***	0.349	***	0.168	***	-0.021		-0.138	***
Other	0.133	**	0.134	**	0.391	***	-0.253	***	-0.14	*
Toilet facility										
Yes and not connected to sewage	0.139	***	0.138	***	0.477	***	0.515	***	-0.091	***
No facility	-0.024		-0.027		0.002		-0.11	**	-0.338	***
Year	-0.045	***	-0.052	***	-0.07	***	0.063	***	0.041	***
Constant	111.867	***	102.927	***	-60.965	***	-139.471	***	-146.222	***

Table 7: Fixed Effect Regression Results for the Wages and Salaries by Industry Groups

Wages and Salaries	GROUP 1		GROUP 2		GROUP 3	
RER Undervaluation	0.218	***	0.054		-0.302	***
Urban/Rural Residence (Urban)	-0.375	***	0.427	***	0.056	**
Age in years	0.004	***	0.003	***	-0.002	***
Gender (Females)	0.199	***	-0.546	***	0.424	***
Marital status						
Married monogamous	0.169	***	-0.111	***	-0.082	***
Married polygamous	0.450	**	-0.192		-0.334	
Divorced/separated	-0.226	***	-0.017		0.132	**
Widowed	-0.089	**	-0.046		0.037	
Not stated	0.408		-0.558		0.203	
Educational level						
Primary/lower secondary	-0.112	***	0.163	***	0.007	
Secondary	-0.162	***	0.099	***	0.123	***
Post-secondary or equivalent	-0.313	***	-0.551	***	0.975	***
University	-0.167	***	-0.772	***	1.183	***
Postgraduate	-0.527	***	-2.176	***	3.380	***
Status of Employment						
Employee	2.746	***	4.237	***	2.363	***
Employer	4.991	***	3.506	***	0.519	**
Own-account, self-employed	5.186	***	3.922	***	0.004	
Contributing (unpaid) family worker	6.442	***	3.085	***	-0.425	**
Not stated	2.482	***	4.384	***	2.300	***
Sector of Employment						
Government	-1.998	***	-0.516	**	1.928	***
Public sector	-0.654	***	0.409		-0.112	
Private sector	-0.250		-0.420	**	0.091	
Joint/cooperative	0.714	**	-0.505		-0.766	**
Other	1.831	***	-3.62	***	1.13	***
Type of Dwelling						
Villa	0.009		0.035		0.140	
Apartment	-0.144	***	0.238	***	-0.042	
Others	-0.234	***	-0.005		0.219	***
Room	0.034	***	0.003		-0.006	
Electrified (Yes)	-0.100		0.230		-0.054	
Water Facilities						
Public tap	0.070	**	0.018		-0.094	**
Well	0.298	***	-0.136	***	-0.260	***
Other	0.274	**	-0.048		-0.234	**
Toilet facility						
Yes and not connected to sewage	-0.042	**	-0.117	***	0.072	***
No facility	-0.016		-0.132		0.121	
Year	-0.047	***	0.046	***	0.003	
Constant	94.254	***	-92.571	***	-5.930	

Table 8: Fixed Effect Regression Results for the Non-Wages Income Groups

Non Wages Income	Agriculture		Nonagriculture		Rentals		Transfers	
RER undervaluation	0.104	***	0.533	***	0.209	***	-0.404	***
Squared undervaluation	0.647	***	-4.095	***	-0.159	**	-2.124	***
Urban/Rural Residence (Urban)	-0.652	***	-1.024	***	-1.573	***	0.349	***
Age in years	0.006	***	-0.004	***	0.000		0.053	***
Gender (Females)	0.798	***	0.279	***	-0.038	***	0.055	***
Marital status								
Married monogamous	-0.034	***	0.296	***	0.006		-1.578	***
Married polygamous	0.135		0.278	**	0.073		-1.814	***
Divorced/separated	-0.473	***	-0.649	***	-0.257	***	0.527	***
Widowed	-0.342	***	-0.659	***	-0.012		-0.169	***
Not stated	-0.909		1.102		1.668		0.680	
Educational level								
Primary/lower secondary	-0.290	***	-0.180	***	-0.038	***	0.117	***
Secondary	-0.216	***	-0.319	***	0.075	***	0.142	***
Post-secondary or equivalent	-0.324	***	-0.503	***	0.032		0.190	***
University	-0.380	***	-0.582	***	0.310	***	0.163	***
Postgraduate	-0.269	***	-0.514	***	0.959	***	0.129	
Status of Employment								
Employee	0.850	***	-0.458	**	0.146		-0.766	***
Employer	4.872	***	3.936	***	0.497	***	-1.504	***
Own-account, self-employed	3.333	***	2.894	***	0.520	***	-0.827	***
Contributing (unpaid) family worker	6.065	***	2.102	***	0.445	***	-1.095	***
Not stated	0.804	***	-0.275		0.143		0.193	
Sector of Employment								
Government	-0.403	***	0.501	**	-0.229		-0.184	
Public sector	-0.237		-0.106		-0.254		-0.315	
Private sector	-0.098		0.111		-0.434	**	0.306	
Joint/cooperative	1.269	***	0.421		-0.209		-0.229	
Other	1.747	***	0.108		-0.407	**	0.652	***
Type of Dwelling								
Villa	-0.429	***	-0.362	**	1.299	***	-0.161	
Apartment	-0.305	***	-0.331	***	-0.106	***	-0.103	***
Others	-0.195	***	-0.214	***	-0.478	***	0.429	***
Room	0.096	***	0.391	***	0.364	***	0.071	***
Electrified (Yes)	0.095		0.606	***	0.169	**	-0.222	**
Water Facilities								
Public tap	0.030		0.040		0.053	**	0.041	
Well	0.347	***	0.169	***	-0.021		-0.138	***
Other	0.131	**	0.406	***	-0.252	***	-0.134	
Toilet facility								
Yes and not connected to sewage	0.139	***	0.478	***	0.515	***	-0.090	***
No facility	-0.024		-0.002		-0.110	**	-0.339	***
Year	-0.051	***	0.009	***	0.073	***	0.056	***
Constant	100.847	***	-15.278	***	-141.592	***	-108.775	***

Table 9: Fixed Effect Regression Results for the Wages and Non-Wages Income Groups

Wages/ Income	Net wages per capita		Non-wage income per capita	
Real exchange rate	20.030	***	3.429	*
Real exchange rate Squared	-2.079	***	-0.377	**
Urban/Rural Residence (Urban)	0.421	***	-0.481	***
Age in years	-0.016	***	0.014	***
Gender (Females)	0.550	***	-0.109	***
Marital status				
Married monogamous	0.327	***	-0.565	***
Married polygamous	0.467	***	-0.558	***
Divorced/separated	-0.710	***	-0.121	***
Widowed	-0.419	***	-0.375	***
Not stated	-2.670		1.495	
Educational level				
Primary/lower secondary	0.073	***	0.032	***
Secondary	0.163	***	0.021	**
Post-secondary or equivalent	0.202	***	-0.018	
University	0.320	***	0.186	***
Postgraduate	0.712	***	0.639	***
Status of Employment				
Employee	2.494	***	-0.796	***
Employer	-1.595	***	0.483	***
Own-account, self-employed	-0.729	***	0.359	***
Contributing (unpaid) family worker	-1.321	***	0.395	***
Not stated	1.108	***	-0.265	*
Sector of Employment				
Government	-0.059		0.206	
Public sector	0.172		-0.124	
Private sector	-0.193		0.118	
Joint/cooperative	-0.022		0.254	
Other	-0.001		0.085	
Type of Dwelling				
Villa	-0.128		0.488	***
Apartment	0.147	***	-0.089	***
Others	-0.104	***	-0.036	*
Room	0.079	***	0.271	***
Electrified (Yes)	0.408	***	0.161	***
Water Facilities				
Public tap	-0.325	***	0.048	***
Well	-0.092	***	0.044	**
Other	-0.024		-0.106	**
Toilet facility				
Yes and not connected to sewage	-0.141	***	0.065	***
No facility	-0.261	***	-0.218	***
Year	0.002	***	0.008	***
Constant	-47.544	***	-15.862	***