WAGE-PRICE CAUSALITY IN THE EGYPTIAN ECONOMY (1990-2005)

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Abstract

This study uses a Granger causality test to examine causality between wage growth and price inflation in Egypt. Two indicators are used as measures of inflation; the consumer price index (CPI) and the wholesale price index (WPI). Wages are classified into public and private sectors wages. The study finds that changes in public sector wages are, in general, independent from changes in prices, as wages in this sector are not determined by market forces. Growth in private sector wages causes price inflation, but wage growth in this sector is a function of lagged changes in prices rather than expected inflation rates. As inflation is caused by several other factors than wages, the delay in the response of wages to inflation runs the danger of declining standards of living and pulling more and more people down to poverty. Strengthening trade unions and collective bargaining could play a very important role in adjusting wages to current inflation. A law that carefully adopts and regulates the practices of collective bargaining and organizes a legal framework that guarantees workers' rights is essential. In addition, there is a need for imposing a minimum wage act to ensure a minimum living standard for workers, and maintain efficiency in the workplace. As these actions may exert some inflationary pressures on prices, a wise monetary policy is needed to contain inflation without impeding economic growth.

ملخص

تستخدم هذه الدراسة اختبار "جرانجر" للسببية لتحليل العلاقة بين نمو الأجور وتضخم الأسعار في مصر. وتعتمد في ذلك على مؤشرين لقياس التضخم: الرقم القياسي لأسعار المستهلكين، والرقم القياسي لأسعار الجملة. ويتم تصنيف الأجور إلى أجور في كل من القطاع الخاص والقطاع العام. وتشير الدراسة إلى أن التغييرات في أجور القطاع العام تكون بشكل عام مستقلة عن التغييرات في الأسعار، ذلك لأن الأجور في هذا القطاع لا تتحدد بفعل قوى السوق. أما نمو الأجور في القطاع الخاص فيؤدي إلى تضخم الأسعار، ولكنه يعد دالة للتغيرات السابقة في الأسعار وليس لمعدلات التضخم المتوقعة. ونظرا لأن التضخم يُعزى إلى عدة عوامل أخرى وليس الأجور فحسب، فإن تأخر استجابة الأجور للتضخم قد ينطوي على خطر انخفاض مستويات المعيشة وزيادة أعداد الفقراء. ويمكن لدعم النقابات العمالية وتفعيل دورها في مجال التفاوض الجماعي أن يسهمان بدور مهم في تعديل الأجور لتتناسب مع التضخم الجاري. ويعد ضروريا في هذا الصدد إصدار قانون ينظم عمليات التفاوض الجماعي ويضع إطارا قانونيا يضمن للعمال حقوقهم. كذلك هناك حاجة لفرض حد أدنى للأجور لضمان حد أدنى لمستوى معيشة العمال مع الحفاظ على الكفاءة في العمل. ونظرا لأن هذه الإجراءات من شأنها ممارسة مزيد من الضغوط على الأسعار، فمن الضروري تطبيق سياسة نقدية حكيمة لاحتواء التضخم دون إعاقة النمو الاقتصادي.

1. INTRODUCTION

Economic literature has identified several factors that are significant in inducing price changes. These factors include: rising labor cost, changes in exchange rate, supply shocks, excess demand generated by expansionary fiscal and monetary policies, and changes in import prices in an open economy (Metwally and Al-Sowaidi 2004). This paper will focus on one of these factors, namely the labor cost, trying to identify whether wage inflation is a cause or an effect of price inflation. Theories supporting the view that wage inflation leads to price inflation consider wages as a cost factor, whose growth—assuming mark-up pricing—will cause price inflation. Alternative theories suggest that inflation results from excess aggregate demand, which exerts pressure on prices to go up. On one hand, employers demand more labor to meet the increase in demand for products, which puts an upward pressure on wages. On the other hand, the increase in prices reduces real wages, urging workers to demand higher wages in later periods. This view supports the hypothesis that price inflation causes wage inflation.

In an attempt to understand the relationship between price inflation and wage inflation in Egypt during the period 1990-2005, Section 2 of this paper reviews the literature and previous studies that aimed at investigating the empirical link between wage growth and price inflation. The purpose is to identify causality effects and assess the relevance of wage growth as an indicator of short-run price changes in the US, Ireland, Switzerland and other countries. In Section 3, the paper proceeds to present an overview of the development of prices and wages in the Egyptian economy from the 1990s until recently. Section 4 presents the Granger-causality test applied to Egypt, examining causality between change in prices and wage inflation, and evaluates the results of the model against the previously presented country experiences. Section 5 introduces the experience of other countries in wage indexation with special reference to the Chilean experience, as a way of mitigating the effect of inflation on households. Finally, Section 6 concludes.

2. INFLATION THEORIES

2.1. The Cost-Push Inflation Theory

It is widely believed that if wage costs rise faster than productivity, the price level may rise as firms pass forward increased wage costs in the form of higher product prices.[1] Hence, changes in productivity-adjusted wages are believed to be a leading indicator of future inflation. (Mehra 2000).

Meanwhile, there are limitations to this cost-push inflation theory. Wages are definitely an important factor in determining prices since they affect firms' marginal costs. However, one has to be cautious as to why higher wages may not cause inflation. If monetary policy actively tries to stabilize inflation, the effect of higher wages is presumably mitigated. Also, if wage negotiations between labor unions and firms in different sectors of the economy are not coordinated, the relative prices of products of different sectors are also affected. This relative price effect will tend to dampen the effect on inflation. Further, even if wage negotiations were coordinated, different labor unions may have different market powers. This may then lead to higher wage increases in sectors with relatively high market power. Regardless of the reasons, as long as wages are less than perfectly correlated, there will be a relative price effect (Jonsson and Palmqvist 2004). It will then be difficult to observe directly the effect of wage inflation on price inflation. This effect will differ from one sector to another, leaving the final effect on prices indefinite.

2.2. Demand-Pull Inflation Theory

An alternative theory of the inflation process is that it is caused by excess aggregate demand. Such theory argues that expansionary monetary policy increases aggregate demand, putting pressure on prices to go up; companies tend to hire and attract more labor by offering higher wages, and unless labor supply is elastic enough, wages will rise. The increase in prices, on the other hand, will lead laborers to bargain for higher wage increases in the following period (the classical theory). Under such analysis, change in wages loses its role as an early indicator of inflation. According to this view, the causation runs from inflation to wage growth, since the resulting increase in prices leads workers to demand higher wages (Mehra 2000).

[1] The view that systematic movements in wages and prices are related derives from the expectations-augmented Phillips curve model on the inflation process. A representation of the model is included in Appendix B.

2.3. Empirical Tests and Country Experience

Studies that aimed at investigating the empirical link between wage growth and price inflation in order to identify causality effects and assess the relevance of wage growth as an indicator of short-run price changes in the US, Ireland, Switzerland, and other countries, have mostly used a Granger-causality model that is based on the expectations-augmented Phillips curve model of the inflation process. According to this model, prices are marked up over productivity-adjusted labor costs (Mehra 1991).

In most cases, empirical evidence showed that price inflation systematically influences wage growth whereas the influence of wage growth on price inflation is much more sensitive to the choice of the sample period under study. The explanatory power of wages disappears in a low inflation environment (Mehra 2000; Zanetti 2005).

The consensus in the empirical literature is that higher wage growth does not cause higher inflation. The econometric literature has typically studied whether wage growth Granger-causes inflation. Most studies have not found any strong indications that this is the case (Hess and Schweitzer 2000). On the other hand, Ghali (1999)[2] finds strong evidence that wage growth Granger-causes price inflation. Aaronson (2001) finds that restaurant prices generally rise with changes in the wage bill. This finding lends an argument to the view that wage-price causality depends as well on the sectors under study. The empirical evidence is thus mixed, but still, most studies conclude that wage growth rarely results in higher inflation.

2.3.1. The United States

Many studies were conducted for the US, testing the causality between price inflation and nominal wage growth. Two models were used; one of the type described in Appendix B, using an expectations-augmented Phillips curve relationship (Mehra 1991, 2000); the other of the type used in this study, and described in Section 4 (Palley 1999). Both models found that this relationship varies with the business cycle, and agreed about the trend of this variation. Palley tested causality between wage inflation and price inflation using three different indicators of price inflation: annualized percentage rate of change in the CPI, annualized

[2] This paper used a different approach and methodology that led to different results. Analysis of data reveals the existence of a deterministic linear time component in the wage and price series. Using Johansen multivariate co-integration technique, the paper provides robust evidence on the consistency of the markup view of the inflation process with the data and concludes that policy makers should profit from labor costs data in predicting future rates of inflation.

percentage rate of change in core inflation,[3] and annualized percentage rate of change in the producer price index. The study covered the period January 1964–December 1997. Data used were in monthly form. Rates of inflation were computed as the first difference of the natural log, and then converted to an annualized percentage rate. The period under study was divided into sub-periods to reflect the three main periods of the recent US economic history; a post-World War II golden age, a period of breakdown in the 1970s, and a new age of diminished expectations that began in the early 1980s. Prior to the great oil shock of 1973, price inflation and wage inflation were unrelated in a Granger-causal sense. In the 1970s, wage inflation was found to cause price inflation. In the 1980s, the relationship was reversed, and price inflation caused nominal wage inflation. In the 1990s, wage growth continued to have no impact on changes in CPI, whereas weak bidirectional causality was found between wage growth and changes in the producer price index (PPI) (Palley 1999). These results support the notion that during high inflation periods, wage growth causes price inflation. This relationship is not maintained during relatively low inflation periods. According to the Phillips curve, high employment levels are accompanied with high inflation. Accordingly, any increase in cost, like that caused by growing wages, will be fully translated into increases in prices, and will not be accompanied with higher output levels.

2.3.2. Switzerland

In Switzerland, a quarterly time series for nominal hourly wages and unit labor costs is constructed from 1975 until 2005 to investigate the empirical link between wage growth and CPI inflation in order to identify causality effects and assess the relevance of wage growth as a leading indicator of short-run price changes. Evidence found that price inflation systematically influences wage growth whereas the influence of wage growth on price inflation is much more sensitive to the choice of the sample period. The explanatory power of wages disappears in a low inflation environment (Zanetti 2005). Evidence from the Swiss data here resembles evidence obtained from the US data.

2.3.3. Ireland

Fountas, Lally, and Wu (1999) conducted a Granger-causality test using an expectations-augmented Phillips curve model, of the type described in Appendix B. By testing causality between wage inflation and price inflation using quarterly data for the period March 1975-

[3] The CPI, excluding food and energy.

March 1992 in Ireland, it was found that Granger causality runs from wage inflation to price inflation, and that the predictive ability of excess demand is weak with respect to wage inflation, but very strong with respect to price inflation. These results imply relatively strong evidence in favor of a mark-up price equation consistent with the expectations-augmented Phillips curve theory of inflation, and very weak evidence for the predictive power of past inflation and the output gap for wages. Accordingly, inflation in Ireland has cost-push elements and very weak support for the existence of demand-pull elements (Fountas, Lally, and Wu 1999). In conclusion, the Irish experience supports the view that causality runs from wage inflation to price inflation and not the other way round.

3. Development of Prices and Wages in the Egyptian Economy

Inflation rates, as measured by the rate of change in the consumer price index (CPI), have significantly slowed down during the second half of the 1990s as compared to the 1980s, when it reached 20-24 percent during the late 1980s and early 1990s. A further look shows that it started accelerating again in the past 4-5 years, reaching as high as 17 percent in 2004, and revolving around 7-8 percent in the last two years (see Appendix A, Table A.1). The step-up in inflation was due to the oil subsidy cuts and their spillover effects on the group of transportation and communications and other related groups. Added to this were the avian flu and its repercussions, along with the inflationary demand pressures arising from higher economic growth (CBE 2007).

A closer look at the CPI figures reveals the increasing rates of growth in food and beverage prices, the group with the biggest share in household expenditure. According to the latest Household Income, Expenditure and Consumption Survey (HIECS) of 2004/05, the average Egyptian household spends around 40 percent of its income on the food and beverage group of products.[4] In the mid-1990s, the rate of increase in the prices of this group of products was revolving around the rate of change in the general CPI. From 2002 onwards, the increase in prices of the food and beverage group of products started to outgrow the increase in the general CPI, showing a 26 percent increase in prices of food and beverage items in 2004 compared to 2003, when the general CPI increased by only 17 percent over the same period (Appendix A, Table A.1).[5] The vital importance of this group of products for

[4] *Source*: CAPMAS website (www.capmas.gov.eg), results of the HIECS of 2004/05.

[5] Similar inflation rates are expected during the second half of 2007, according to the latest announcements of CAPMAS president, especially concerning major food items such as rice and wheat.

household expenditure exacerbates the feeling of households of a declining standard of living, unless their nominal income is increasing at higher rates to prevent real income from deteriorating.

Wages constitute the main source of income for the majority of Egyptian households.[6] Wages in the public and private sectors are growing since 1990 at different rates, without demonstrating an obvious trend. Starting from an equal base in 1990, wages in the public sector soon outgrew those in the private sector. By 2005, public sector average wage was one and a half times as high as the private sector average wage (Appendix A, Table A.1).

The growth in wages in both public and private sectors is not due to growth in labor productivity. The latter has been stagnant, if not declining, over the last two decades (especially in the industrial sector). The stagnation of labor productivity in the public sector could be explained by the growing numbers of labor employed to an almost fixed level of capital (with investments in the public sector declining throughout the last decade). The rate of growth of productivity in the private sector has been higher than that in the public sector since the 1990s, but not high enough when compared with the growth in capital employed by the private sector. The reason might be due to the low level of skills and training that characterizes the majority of labor in Egypt, which makes the productivity of capital in Egypt 50 percent less than the productivity of the same capital in its country of origin (El-Issawy 2007).

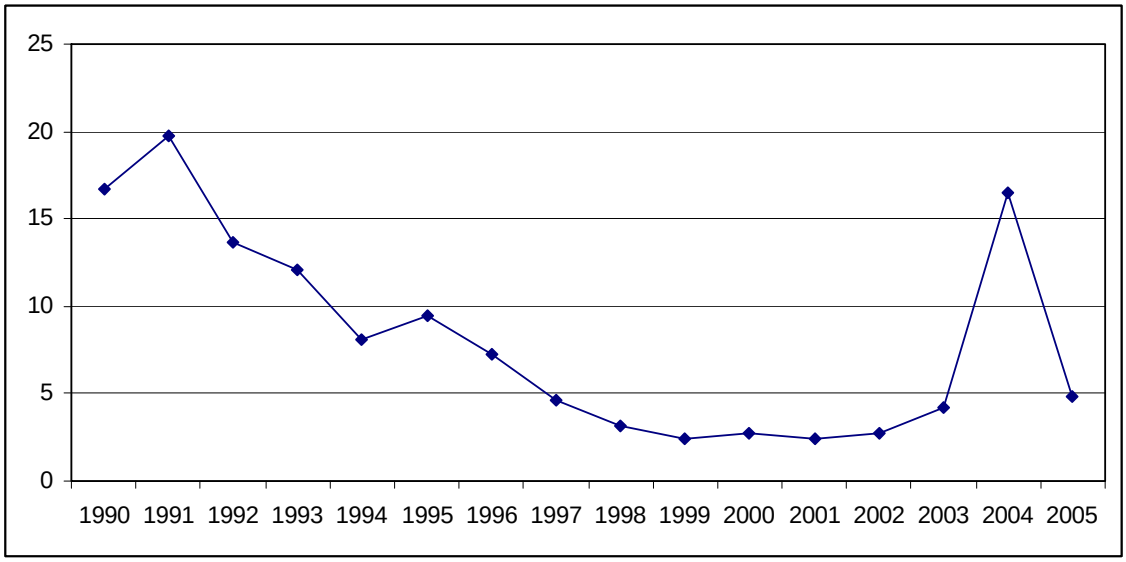
3.1. Inflation Rates during the Period 1990-2005

Inflation rates reached very high levels in the 1980s. Coupled with high external and internal debt, it was unavoidable for the Egyptian government to implement a structural reform program to rectify these macro imbalances. The year 1990/91 witnessed the start of the Economic Reform and Structural Adjustment Program (ERSAP), which aimed at providing measures to cut spending while increasing real output (Korayem 1997). The program produced a remarkable turnaround in Egypt's macroeconomic performance. Inflation declined from 20 percent in 1991 to 9 percent in 1995, as a result of the declining liquidity growth from over 27 percent in 1990/91 to 10.5 percent in 1996/97 (Subramanian 1997). Budget deficit declined from 17 percent of GDP to 0.9 percent over the same period of time (El-

[6] According to the HIECS of 2004/2005, salaries and wages constitute around 50 percent of the average urban household income.

Refaie 2001). All this was a result of successful coordination between monetary and fiscal policies conducted from 1991/92 until 1997/98. Both policies were contractionary, aiming at stabilizing prices and reducing internal and external debt. The coordination afterwards was not as effective. The restrained fiscal policy became expansionary, which led to an increase in budget deficit to 4.2 percent of GDP in 1998/99. Monetary policy continued to be restrictive with the exception of high short-term injections of liquidity (El-Refaie 2001). A turning point for the inflation trend was the floatation of the pound in January 2003 (Kheir-El-Din and El-Laithy 2006), which raised inflation from 3 percent in 2002 to about 17 percent in 2004. Such change in policy directions led to reversing the trend of the rate of inflation to an increasing one.

Figure 1. Rate of Growth of CPI (%)



Source: Authors' calculations based on CAPMAS CPI monthly bulletins. Appendix A, Table A.1.

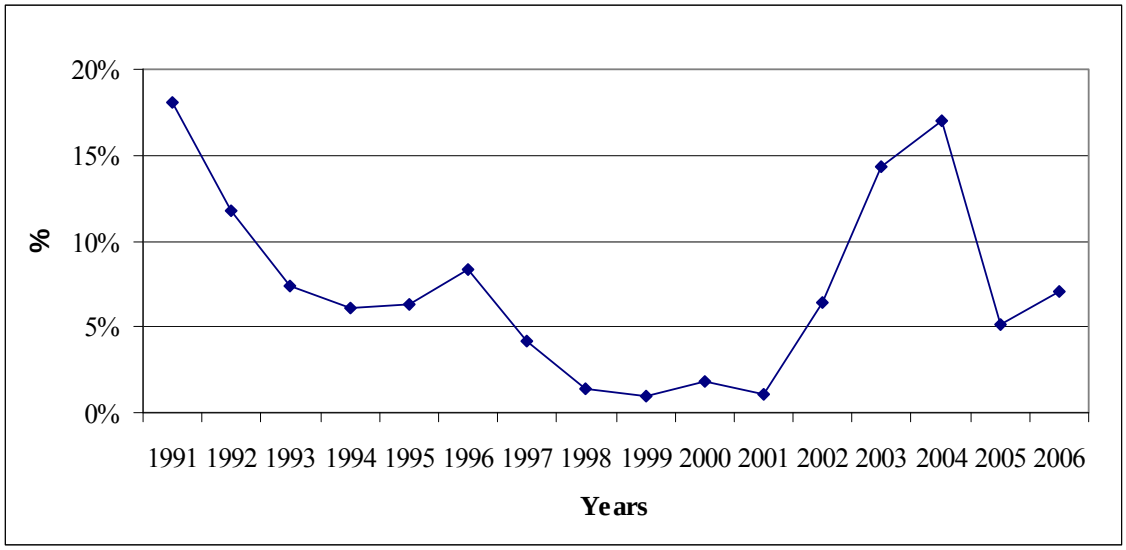
As the CPI is not the only indicator of inflation, it is useful to look at another common measure of inflation, which is the wholesale price index (WPI).

The WPI succeeds in showing the primary effects of external shocks on the economy, something that the CPI fails to reflect. The development of the WPI resembles that of the CPI all through the 1990s. In 2002 and 2003, the WPI reflected the effect of the exchange rate devaluation on prices more strongly than the CPI.[7] That is why it is worth studying the

[7] Appendix A, Table A.2.

causality between wage inflation and price inflation using both CPI and WPI as measures of inflation.

Figure 2. Rate of Growth of WPI in the Period 1991-2006 (%)



Source: Authors' calculations based on CAPMAS data.

2.2. Public and Private Sector Wages during the Last Two Decades

As wages are a major source of income for households as well as a major cost component in production, it is important to look at the development of wages in both the public and private sectors to see whether inflation was a cause or an effect of the development of wages in the economy.

A survey on employment, wages, and labor hours is conducted annually by CAPMAS. Wages for public and private sectors are gathered in the first week of October of each year. The choice of the month of October is based on the stability of employment among different economic activities during this month. It is characterized as well by being away from the beginning and the end of the fiscal and calendar years. The survey excludes wages in the agricultural sector and the government.[8]

A look at Table A.3[9] shows that the growth in public sector wages seems to be independent of the inflation rate. Whereas, during the 1990s, the rate of growth in private

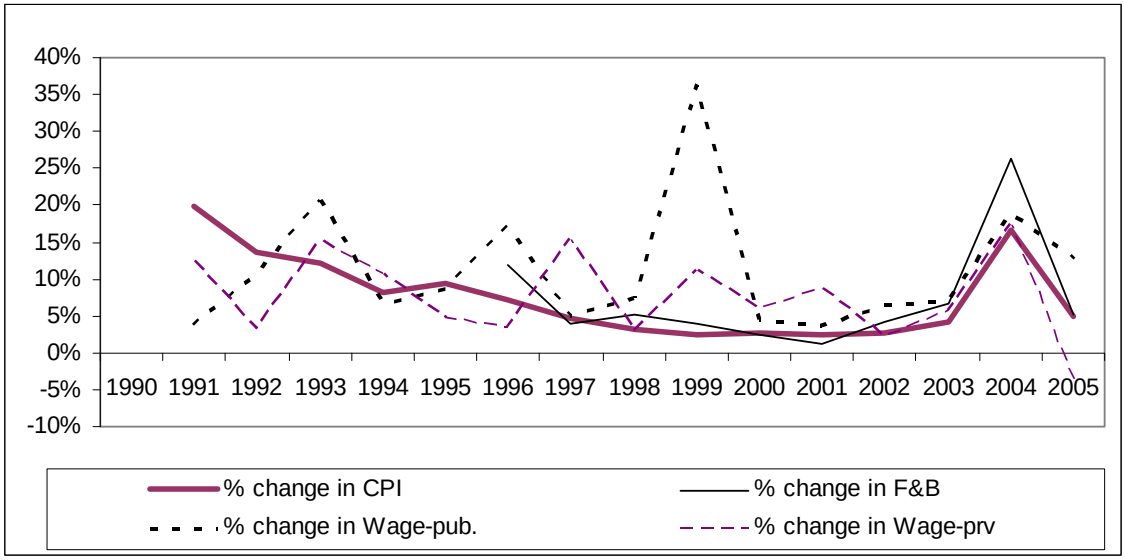
[8] The methodology followed in classifying employment and wage data is outlined in CAPMAS Employment, Wages and Labour Hours Bulletin.

[9] Table A.3, Appendix A shows the growth in public and private sector wages as compared to the inflation rate.

sector wages lags behind the inflation rate by two years, and steps ahead of it in the next two consecutive years. Starting the 3rd millennium, this trend disappears.

Comparing the rate of growth of private and public sector wages to the rate of growth of urban CPI and food and beverages group of products, it appears that wages in the private sector show slower growth rates than the general CPI and the food and beverage price index starting 2003. Though the latest released data for wages is for 2005, the trend is expected to continue with the growing prices of food and beverage products. Public sector wages continue to grow faster than inflation rates in many time periods. As much as this is true according to CAPMAS reported CPI and wage data, one needs to keep in mind that the CPI, according to its current structure, tends to be undervalued (Fares 1997).

Figure 3. Development of Wages and Consumer Prices in the Period 1990-2005



Source: Authors' calculations.

As mentioned earlier, wage growth cannot be attributed to productivity growth. Hence, it might be due to inflationary pressures. A steady source of growth in wages, especially in the public sector, used to be the annual increment announced yearly on Labor Day by the president of Egypt. An alternative periodic increment, every July, has recently replaced it. Though wages are not fully indexed to prices, most of the periodic increases in wages have been described as inflation allowances, with some exceptions in the service sector where labor productivity was claimed to increase (El-Issawy 2007). In general, demand for wage raise

seems to be a function of ex-post rather than ex-ante inflation, especially in light of the absence of collective bargaining and organized trade unions (Metwally and Al-Sowaidi 2004).

4. METHODOLOGY AND APPLIED MODEL

Up to this point, the relationship between wage growth and price inflation in Egypt is not clear. The question of causality between these two variables is tested using a Granger-causality test. This section presents an overview of the methodology, followed by an application to the Egyptian case, and concluding with the findings of this test.

4.1. Granger-Causality Test

4.1.1. Methodology

The Granger causality test assumes that the information relevant to the prediction of the respective variables, CPI, WPI and Wages (W), is contained solely in the time series data on these variables. The test involves estimating the following pair of regressions (based on Gujarati 2003):

$$CPI_t = \sum^{m}_{i=1} \alpha_i W_{t-i} + \sum^{m}_{j=1} \beta_j CPI_{t-j} + u_{1t} \quad (1)$$

$$W_t = \sum^{m}_{i=1} \lambda_i W_{t-i} + \sum^{m}_{j=1} \delta_j CPI_{t-j} + u_{2t} \quad (2)$$

Where CPI_t denotes the rate of change in CPI in time t (i.e., inflation rate); CPI_{t-j} denotes lagged inflation rates; W_t denotes wage inflation in time t; and W_{t-i} denotes lagged wage inflation. It is assumed that the disturbances u_{1t} and u_{2t} are uncorrelated. Equation 1 postulates that the inflation rate is related to past values of itself as well as of W_t, and Equation 2 postulates a similar behavior for W_t. The decision is made based on the value of the sum of estimated coefficients of W_t and CPI_t.

This exercise is repeated using the WPI_t as an inflation indicator instead of the CPI_t in the above model, (i.e., substituting rate of change of WPI for rate of change in CPI) and testing causality between rate of change of WPI and rate of change of wages in the period from 1994 to 2005.[10]

[10] Data available for WPI from CAPMAS are found in monthly form only starting 1994. Before this date, the WPI is available as annual figures. Annual WPI from 1990 to 2005 is presented in Appendix A, Table A.2.

To show how wage-price causality is sensitive to the choice of the economic sector under study, the exercise is also conducted on both the clothing and footwear group of goods, and the hotels and restaurants group of products as representatives of goods and services sectors, respectively. The same model is used, but substituting the relevant price index for each group of the above products and its respective average wage for both the private and the public sectors, instead of the general CPI and the general average public and private sectors' wages in the model. The results here have to be treated with caution. The wages used to represent clothing, ready-made garments and footwear products are the average weekly wages in the manufacturing sector. The reason for this is that there is no weighted average for the weekly wage in the public or private sector that represents the clothing and footwear sector as a whole, but rather an average wage for the spinning and weaving, then the ready-made clothes and fur dyeing, and another for leather dyeing and footwear manufacturing. The weighted averages are available only for the main economic activities like manufacturing. That is why this study uses wages in the public and private manufacturing sectors as a proxy for average wages in the clothing and footwear sector. By plotting the average wages prevailing in the previously mentioned sub-sectors, they demonstrated a similar trend to the overall wages of the manufacturing sector, which makes the wages of the manufacturing sector an acceptable proxy for the textiles sector.

The authors also have doubts about wages in the hotels and restaurants sector. It is to our surprise that wages in private sector hotels and restaurants are very volatile showing frequent increments and reductions.[11] Not only that, but starting 1997 they became way below the average wage in public sector hotels and restaurants. A more intuitive impression is that wages, especially in the hotels and restaurants sector, are higher in the private than the public sector. Also, wages are known to be sticky downwards, which makes it difficult to accept these ups and downs without hesitation. By inquiring about employment in the hotels and restaurants sector, it was found that some of the employees employed in publicly owned hotels that are privately managed belong to the public sector, which partially explains the higher public sector wages.

[11] Appendix A, Table A.4.

4.1.2. Limitations of the Granger-causality test

Though useful, the Granger-causality analysis has limitations. First, it identifies "temporal" causality rather than theoretical causality, which may result in the danger of the rooster and the sunrise problem. In our study, this risk is minimized as causality between wages and prices is backed by economic reasoning as indicated by both cost-push and demand-pull inflation theories. Second, the analysis involves looking for a statistical relationship between variables X and Y, for instance, but it is possible that a third variable Z may be what matters, and thus X is only proxying for the effect of Z. Third, the analysis focuses on the relationship between lagged values of X, for instance, and current values of Y. However many economic relationships involve simultaneous interaction of variables and this simultaneous causal dimension is not picked up at all. Despite these limitations, the Granger-causality test remains a useful diagnostic tool. But no one single piece of evidence is ever enough. Instead, an array of evidence is needed to prove an economic relationship (Palley 1999; Pindyck and Rubinfeld 1991).

Description of the data used, methodology and tabulated results of the test are presented in Appendix C.

4.2. The Results of the Test

By running the regression using 4 lagged periods (i.e., 1 year) and 8 lagged periods (i.e., 2 years), of the variables CPI_t, W_t-pub and W_t -prv, the results show that the inflation rate is independent from the rate of change in public sector wages. Meanwhile, there is a unidirectional causality running from the rate of change in private wages to price inflation at a 5 percent level of significance, when considering 4 lagged periods of inflation rate and private sector wages (i.e., 1 year). With longer lags (8 lagged periods), unidirectional causality disappears from private sector wage inflation to price inflation, but appears in the opposite direction (from price inflation to private sector wages).[12]

The relatively quicker response of price inflation to changes in private sector wages could be attributed to the mark-up pricing scheme adopted in many markets, and to the presence of market imperfections that may allow some monopolistic behavior. The reason

[12] It is important to note that the analysis here focuses on non-agricultural wage adjustments to changes in prices, as the wages used in the analysis exclude the agricultural wages. Government and informal sector are also absent in this analysis.

why private wages take longer time in responding to price inflation goes back to the absence of trade unions—in many economic activities—and of collective bargaining, as well as to the relatively elastic supply of labor in many markets.

The results show that cost-push factors are more dominant when explaining inflation in the short run, whereas demand-pull factors are more pronounced in explaining the inflation process when considering longer time lags.

These results are in line with Metwally and Al-Sowaidi (2004) who claim that wages respond to lagged changes in the rate of inflation rather than inflationary expectations, due to the absence of organized trade unions, collective bargaining, wage-price indexation, and minimum wage policy in the Egyptian economy.

The lagged response of private sector wages to changes in prices, and the absent relationship between public sector wages and inflation rates run the danger of declining standards of living due to this lagged adjustment. This brings up the importance of considering policies aiming at protecting households against rising inflation and deteriorating standards of living.

The results of the Granger-causality test between the rate of change of WPI—as a measure of inflation—and wage growth lend more support to the demand-pull theory of inflation. It is the growth in prices that leads to wage increases and not the other way round. That is obvious when the rate of change of private sector average wages is regressed on the rate of change in WPI, yet this relation did not prove significant concerning the public sector wages. This test cannot capture the magnitude of this relationship to tell us by how much and after how long wages catch up with price increases. Accordingly, it does not support the role of the government, trade unions or collective bargaining in compensating workers for the increase in prices.

By conducting this test at the level of economic activities, the results looked quite different. The literature studied proposes that prices are more sensitive to wage growth in the services sector than they are in the goods sector; whereas data on the Egyptian economy lead to an opposite conclusion. Wage growth in both private and public manufacturing sectors Granger-causes price inflation of the clothing and footwear group of products during the period from 1995 to 2005, at a 5 percent level of significance. A bidirectional causality

between private sector wages and prices is noticed at a lower significance level (10 percent).[13] There is no causality between prices and wages in the hotels and restaurants sector in either direction when using 4 lagged periods. Though growth in public sector wages causes price inflation of the hotels and restaurants group of products when considering longer lagged periods (8 lagged periods), the results still deviate from the literature. It is intuitive that wages influence prices of non-tradable products more than they do with tradable products. Given the concerns mentioned earlier about the reliability of the wages time series provided for the hotels and restaurants sector, and the unexpected results of the undertaken test, we tend to be hesitant about accepting the results of the test applied to this sector.

In conclusion, on the macro level, private sector wages are more responsive to price changes than public sector wages. This indicates that public sector wages are being administratively determined rather than left to market forces. The effect of wage growth on price inflation is more pronounced in the short run, whereas the effect of price inflation on wage growth is more pronounced in the medium run (after 8 lagged periods). Accordingly, we may conclude that cost-push factors of inflation are dominant in the short run, whereas demand-pull factors dominate in the medium run. Thus, nominal wages take longer to adapt to the increase in prices, leaving real wages to deteriorate in the short run.

At the sectoral level, wages and prices of the same economic sector exhibit a stronger relationship. The growth in wages in the clothing and footwear industry in both public and private sectors induces growth in the prices of goods produced by this sector in the short run. The relationship is bidirectional between growth of private sector wages and growth in prices of clothing and footwear products over the short and medium run. Causality runs from growth in public sector wages to growth in clothing and footwear prices. The relationship is unidirectional and only appears in the short run, which still supports the notion that public sector wages are administratively determined.

In the hotels and restaurants sector, causality is proven only between growth in public sector wages and changes in the price index of hotels and restaurants, yet the reservations mentioned about the wages in this sector prevent generalization of the results of this test.

[13] These results are obtained when considering 4 lagged periods. In the longer term (with 8 lagged periods), causality remains running from private sector wages to prices of clothing and footwear.

The results of this test highlight the importance of evaluating the development of real wages in the Egyptian economy and among all economic sectors. As changes in nominal wages are not in line with inflation rates, or under the best scenario lag behind them, the policy maker must consider introducing some measures that target stabilization of real wages, and prevent the deterioration of living standards.

Among the policies that work on stabilizing real wages is the wage indexation policy. Chile has a leading experience in wage indexation as a cost-of-living adjustment mechanism. The following section outlines this experience.

5. WAGE INDEXATION

5.1. What is Wage Indexation?

Formal labor contracts sometimes include automatic cost-of-living adjustment (COLA) provisions (Dornbusch, Fischer, and Startz 2004). COLA provisions link increases in money wages to increases in the price level, thus indexing wages to inflation. COLA clauses are designed to allow workers to recover, wholly or in part, purchasing power lost through price increases since the signing of the labor contract. This form of indexation is a common feature of the labor markets in many countries. The objective of indexation is to strike a balance between the advantages of the long-term wage contracts and the interests of workers and firms by maintaining real wage stability. There are two options for adjusting wages to price increases. One is to index wages to the CPI or GDP deflator and, through periodic reviews (e.g., quarterly or annually), to increase wages by the increase in prices over the period. The other is to schedule periodic, pre-announced wage increases based on the expected rate of price increase. If expected inflation equals actual inflation, the outcome of the two ways is identical. But as inflation usually differs from expectations, there are discrepancies between the two options (Crowley 1997).

Indexation is frequently used in countries with uncertainty about high inflation; whereas in countries with prevailing low inflation rates, pre-announced wage increases are more commonly used.

Academicians are usually concerned that indexation would feed into an inflation spiral. If we consider, for example, a supply shock or a rise in raw material prices, firms may pass these cost increases to prices of final goods. In turn, the CPI would rise, and wages, being

indexed to CPI, would consequently rise, leading to further price increases, and so on. Such a spiral effect could have been avoided in the absence of indexation. The literature differentiates between the effects of wage indexation after a supply shock as compared to a demand shock. Under demand shocks, there is a pure inflation disturbance, and firms can afford to pay the same real wages, which limits the real effects of 100 percent wage indexation. But under supply shocks, real wages should be allowed to fall, which is prevented by the presence of indexation.

5.2. What Makes Governments Reluctant to Index?

Economists often advise governments to index on a broad scale; i.e., to index all the tools they control such as bonds, taxes and wages. In this way, inflation will be easier to live with, as most of the costs of unanticipated inflation will disappear. Nevertheless, governments remain reluctant to index. They are concerned about the economy's ability to absorb real supply shocks, and about having inflation rates going out of hand, after being much easier to live with, making the economy worse off, since indexation cannot deal with all the consequences of inflation.

Some econometric models showed that if labor contracts specify forward-looking wage indexation instead of backward-looking wage indexation, or wages based on static expectations, such contracts will result in greater reduction in inflation with lower output costs, smaller misalignment of real wages, smaller outflows of reserves, smaller disruptions caused by policy announcements, and a reduced impact of some shocks during price stabilization programs. In addition, because forward-looking wage indexation leads to more stable real wages, it should be politically feasible to introduce. These results are generally true whether or not capital is mobile, and whether or not expectations are rational.[14]

Are these concerns unavoidable? The aggregate consequences of wage indexation generally depend on the nature of monetary policy (among other macroeconomic conditions). The Chilean experience shows that it is possible to curb inflation and lower it to very acceptable levels under a highly indexed economy. Israel and Turkey had quite similar experiences (Rivlin 2003), yet the most successful is the Chilean experience.

[14] Crowley (1997) includes a detailed description of the model and its outcome. A counter argument about the practicality of using backward-looking indexation, and the non-practicality of the forward-looking indexation is presented in Jadresic (1998).

Chile's experience shows that wage indexation is possible under inflation targeting, and does not necessarily lead to a wage-spiral effect, despite the caused inflation inertia. In response to indexation, price stabilization in Chile was the most gradualist in the world. Inflation has been brought down step by step (from 24 percent in 1990 to 3 percent in 1999). Chile is among the first countries that adopted an explicit publicly announced annual inflation target. In addition, it adopted inflation targeting while suffering from very high inflation rates unlike more industrialized economies, which targeted inflation when it was already low (Landerretche, Morandé, and Schmidt-Hebbel 1999).

A major reason for the success of Chile's monetary framework based on inflation targeting may be the credible announcement of the target. The use of a pre-announced inflation objective by a central bank that is strongly committed to its achievement helped overcome the effects of inflation inertia in a country with a widespread indexation practice as is Chile. Now, policy makers in Chile are committed to an inflation target of 2-4 percent annually, with indexation still ruling wages, interest rates and taxes. This is a success story that needs to be further studied and analyzed. Recently, some Chilean officials started blaming wage indexation for being the reason behind wage rigidity, which prevents wage adjustments during low inflation periods.[15]

5.3. Is Wage Indexation a Viable Solution for Adjusting Real Wages in Egypt and What are the Alternative Solutions?

With rising inflation rates in Egypt, we might need to consider wage indexation as a means of stabilizing real wages, as wages constitute the main source of income for households. Meanwhile, wage indexation requires the existence of formal contracts that include a COLA provision specifying the link between nominal wage changes and price changes. The large informal sector and the existence of many workers who work in the private sector on a part-time basis or with no formal contracts in Egypt make the indexation task very difficult. Many workers will be left out. As indexation might feed into an inflation spiral, workers without formal contracts, which are assumed to be many in the Egyptian economy, will suffer a lot under such a system. Currently, there are 20-23 million laborers employed in Egypt, of whom 5.7 million are government employees, 6 million in the agricultural sector, and about 6

[15] Klaus Schmidt-Hebbel (Central Bank of Chile) during discussions at the ECES conference on "What Drives Prices in Egypt," held in November 2007.

million in the informal sector.[16] The rest is hired by the formal business sector—both public and private. A labor market with such structure is very difficult to manage using such wage adjustment tool.

Though wage indexation appears to be not suitable for the Egyptian economy, inflation targeting is still recommended. If Chile succeeded in adopting explicit publicly announced annual inflation targets, while suffering from very high inflation rates, then Egypt must be in a better position, starting from much lower inflation rates, to follow suit and commit itself publicly to an annual inflation target. It is true that monetary policy in Egypt has price stability as its primary objective (CBE 2007), but it has not publicly announced its inflation objective. Credible commitment to a pre-set inflation target may strongly influence expectations about future inflation, which can help achieve our current inflation target. This, in turn, will help stabilize real wages. Yet, an assessment of the prevailing wages is required. In light of the current increases in prices, and without revising wages, they will lose their role as motives for higher productivity, which will negatively affect output efficiency. Laws regulating collective bargaining are recommended to help adjust wages among different economic sectors, to maintain efficiency in the workplace. In addition, the government must consider imposing a minimum wage that ensures a decent standard of living, which is at least above the international poverty line. Average weekly wages in both the private and public sectors in 2005 were LE 169 and LE 261, respectively.[17] For a family consisting of five members, the per capita income per day is LE 4.8 for an individual in a family whose breadwinner is a private sector employee, and LE 7.5 for an individual in a family whose breadwinner is a public sector employee. Both families are almost living on the international poverty line or slightly above it. Yet, one needs to bear in mind that these average wages could be biased upwards if one considers the impact of the high wage earners on this average. Unfortunately, the maximum and minimum wages are not available, nor the quintile distribution for the wages to allow us to estimate how many workers are paid below the average. Meanwhile, we can conclude that since many workers are paid below the average wage, then many families, whose breadwinners work in the formal public and private sectors, live under the international poverty line—let alone the government, the informal and the agriculture sectors' workers, in addition to the growing number of unemployed workers.

[16] Samir Radwan during the ECES conference "What Drives Prices in Egypt."

[17] Figures from Appendix A.

6. SUMMARY AND CONCLUSION

The study shows that changes in public sector wages are, in general, independent from changes in prices, as the former are not determined by market forces. Growth in private sector wages causes price inflation, but wage growth in this sector is a function of lagged changes in prices rather than expected inflation rates. Inflation is caused by several factors other than wages, including supply shocks like cuts in oil subsidy or expansionary monetary and fiscal policies or imported inflation. Therefore, the delay in the response of wages to inflation arising from such factors runs the risk of declining standards of living and pulling more and more people down to poverty. The clothing and footwear sector lends some support to the power of wages as early indicators of inflation in this sector, as the growth in either the private sector or public sector wages causes price inflation of clothing and footwear. Again, one has to be careful in dealing with this result, as the aggregate manufacturing sector average wages are used as a proxy for average wages in the clothing and footwear sector.

Some countries use wage indexation as a means of mitigating the effect of inflation on real wages. In the Egyptian case, caution must be observed as the majority of workers do not have formal contracts (considering the agricultural sector, part-time private sector employees, and informal sector labor). If some workers will enjoy wage indexation and the rest will not, workers without formal contracts will suffer more and more inflationary pressures. Stronger trade unions and collective bargaining could play a very important role in adjusting wage growth to current inflation. A law that carefully adopts and regulates the practices of collective bargaining, and establishes a legal framework that guarantees workers' rights is essential. In addition, there is a need for imposing a minimum wage act to ensure a minimum living standard for workers, and maintain efficiency in the workplace. As these actions may exert some inflationary pressures on prices, a wise monetary policy is needed to contain inflation without impeding economic growth.

APPENDIX A

Table A.1. Development of Wages and Prices in Egypt (1990-2007)

Year	Wage-Pub. Sector	Wage-Prv. Sector	CPI– Urban	Food, Beverages and Tobacco	Inflation Rate	Rate of Growth in F&B Prices
1990	55	57	46.1		17%	
1991	57	64	55.2		20%	
1992	63	66	62.7		14%	
1993	76	76	70.3		12%	
1994	81	84	76		8%	
1995	88	88	83.2	77.7	9%	
1996	103	91	89.2	86.9	7%	12%
1997	108	105	93.3	90.4	5%	4%
1998	116	108	96.2	95	3%	5%
1999	158	120	98.5	98.7	2%	4%
2000	165	127	101.2	101.1	3%	2%
2001	171	138	103.6	102.2	2%	1%
2002	182	141	106.4	106.5	3%	4%
2003	195	149	110.9	113.5	4%	7%
2004	232	175	129.2	143.5	17%	26%
2005	261	169	135.5	150.8	5%	5%
2006			146.0	167.3	8%	11%
2007			156.8	183.3	7%	10%

Source: Provided by CAPMAS upon the authors' request.
1. CPI-urban figures displayed in this table are annual averages with base year 1999/2000.
2. CPI of 2007 is calculated for Jan.-July 2007.
3. Wages are disaggregated into public and private sector wages. Data for wages are collected once a year in the first week of October. The choice of the month of October is based on the stability of employment among the different economic activities during the year. Accordingly, this average weekly wage could be a good representative of the annual average wages.
4. Wages are expressed in LE per week.
5. Wage data exclude wages in the agricultural sector and the government, and represent public sector and formal private sector wages only.
6. The index number for food and beverages group of products is presented on the basis of urban CPI figures.
7. Inflation rate and the rate of change of the food and beverages prices are calculated by the authors.

Table A.2. WPI Annual Development

Calendar Year	WPI	Percentage Change in WPI
1990	59.2	
1991	69.9	18.1%
1992	78.1	11.7%
1993	83.9	7.4%
1994	88.98	6.1%
1995	94.61	6.3%
1996	102.49	8.3%
1997	106.77	4.2%
1998	108.26	1.4%
1999	109.25	0.9%
2000	111.19	1.8%
2001	112.34	1.0%
2002	119.52	6.4%
2003	136.71	14.4%
2004	160.03	17.1%
2005	168.32	5.2%
2006	180.14	7.0%
2007[2]	196.23	

Source: CAPMAS, Monthly WPI is provided as of 1994. The above annual averages are an aggregation of the monthly figures. WPI before 1994 is available in annual averages only.

1. Base year for prices: March 1996 = 100. 2. Calculated until September 2007.

Table A.3. Development of Private and Public Sectors Wages and of Inflation

Year	Rate of Growth of W-pub.	Rate of Growth of W-prv.	Inflation Rates
1991	4%	12%	20%
1992	11%	3%	14%
1993	21%	15%	12%
1994	7%	11%	8%
1995	9%	5%	9%
1996	17%	3%	7%
1997	5%	15%	5%
1998	7%	3%	3%
1999	36%	11%	2%
2000	4%	6%	3%
2001	4%	9%	2%
2002	6%	2%	3%
2003	7%	6%	4%
2004	19%	17%	17%
2005	13%	-3%	5%

Source: Authors' calculations based on CAPMAS data.

Table A.4. Development of Private and Public Wages in the Manufacturing and Hotels and Restaurants Sectors

Year/Sector	Manufacturing Sector		Hotels and Restaurants	
	Public	Private	Public	Private
1991	56	54	57	61
1992	63	58	63	56
1993	72	64	67	95
1994	79	72	66	83
1995	90	73	77	88
1996	102	76	115	64
1997	113	90	137	109
1998	120	90	134	87
1999	140	97	148	94
2000	157	100	149	99
2001	168	117	143	108
2002	173	123	216	114
2003	183	121	224	116
2004	219	149	189	128
2005	247	147	133	156

Source: CAPMAS, several issues of the annual bulletin of Employment, Wages and Labour Hours.

1. Until 1995, hotels and restaurants group included trade as well.
2. Wages in manufacturing are a proxy for clothing and footwear, as there is no aggregated average for textile and clothing, ready-made clothes, and footwear and leather products.

Table A.5. Urban CPI

Month/year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Clothing and Footwear	57.7	65.2	69	70.4	71.6	73.4	75	76.6	77.8	89.5	94	95.6
Hotels and Restaurants	49.2	58.6	64.5	68	71.5	72.6	75	75.7	77.4	90.8	92.2	96.1

Source: Provided by CAPMAS upon the authors' request.
- Jan 2007=100.
- Clothing and footwear: annual average for the price index of the group.
- Hotels and restaurants: annual average for the price index of the group.

APPENDIX B

The Expectations-Augmented Phillips Curve Model

This model was used in many studies to test the relationship between wages and prices. A central proposition in the expectations-augmented Phillips curve model of the inflation process is that prices are marked up over productivity-adjusted labor costs. If that is true, then long-run movements in prices and labor costs must be correlated.

The expectations-augmented Phillips curve model can be represented by the following system of equations (Fountas, Lally, and Wu 1999; Mehra 1991; and Ghali 1999).

$$\Delta p_t = h_0 + h_1 \Delta(w_t - q_t) + h_2 G_t + h_3 S_{pt} \quad (1)$$

$$\Delta(w_t - q_t) = k_0 + k_1 \Delta p_t^e + k_2 G_t + k_3 S_{wt} \quad (2)$$

$$\Delta p_t^e = \sum_{j=1}^{n} \mu_j \Delta p_{t-j} \quad (3)$$

All variables are expressed in natural logarithms, where p_t is the price level, wt is the wage rate, G_t is an output gap variable, q_t is labor productivity, p_t^e is the expected price equation, S_{pt} is a supply shock on the price equation and S_{wt} is a supply shock on the wage equation. Equation 1 describes price mark-up. Prices are affected by productivity-adjusted wages (w-q), excess demand, and an exogenous supply-side shock. Equation 2, a Phillips curve, includes the three factors that affect wages: expected price change, an excess demand variable, and a supply shock. Finally, Equation 3 is an implication of adaptive expectations where the expected price change is a weighted average of past changes in prices.

Import prices and oil prices are used as proxies for the supply shocks, S_{pt} and $S_{wt,}$ respectively. The excess demand (output gap) variable is proxied by the gap between potential and current GDP.

APPENDIX C

C.1. Notes about the Granger-Causality Test

1. There are several factors that need to be considered before running a Granger test:

   a. It is assumed that the variables CPI and W are stationary. *After taking the rate of change in CPI, and the rate of change of public sector and private sector wages, of the Egyptian economy (1990-2005), the data set became significantly stationary after taking the first differences (using a Ducky-Fuller test).*

   b. The number of lagged terms to be introduced in the causality tests is an important practical question. An Akaike or Schwarz information criterion could be used to make the choice. Direction of causality may depend critically on the number of lagged terms included. *This study used the Akaike information. The Akaike information criterion was accepted for the two lagged terms included (4, 8).*

2. Limitations of the Granger causality test: A weakness of this test of causality is that a third variable Z might in fact be causing Y, and be contemporaneously correlated with X (Pindyck and Rubinfeld 1991).

C.2. The Granger-Causality Test Run on Egyptian Prices and Wage Data for the Period 1990-2005

Data

Urban CPI, WPI, average wages in the private and public sectors, price index of clothing and footwear, price index of hotels and restaurants, manufacturing private and public sectors wages, and hotels and restaurants public and private sector wage data are obtained from CAPMAS and presented in Appendix A. Monthly CPI (general and for relevant groups of products) and WPI figures are used to obtain the quarterly averages (not presented). Wages are disaggregated into public and private sector wages, provided by CAPMAS as the wages of the first week of October of every year. A partitioning technique is used to change the low-frequency set of data into a high frequency one. A quadratic match average method is used to fit a local polynomial for each observation of the low frequency series, and then this polynomial is used to fill in all observations of the high frequency series associated with the period. The quadratic polynomial is formed by taking sets of three adjacent points from the source series and fitting a quadratic so that the average of the high frequency point matches the low frequency data actually observed. For most points, one point before and one point after the period currently interpolated are used to provide the three points. For the end points,

the two periods are both taken from the one side where data is available (Lind, Marchal, and Wathen 2005).

As wages are disaggregated into two series: public sector wages denoted as (W-pub) and private sector wages (W-prv), each regression is repeated twice, using each of the two series.

From the original set of data, the rate of change of each variable is obtained. The regression is run first to test for causality between price inflation, as measured by rate of change of urban CPI, and wage growth, then repeated using the rate of change of WPI as another measure of inflation. To perform the same test at the sectoral level, the regression is repeated twice, once using the wages and prices relevant to the clothing and footwear sector, and another time using the wages and prices of hotels and restaurants sector.

The data for urban CPI and wages are available for the period 1990-2005. Monthly WPI figures are available as of 1994, monthly price indices for clothes and footwear, and hotels and restaurants are available as of 1995.[18]

The regressions are run for 4 and 8 lagged periods of each of the dependent and independent variables. They are repeated with the same lags after including a dummy variable from 2001 to account for the effect of devaluation of the Egyptian pound.

C.3. Results of the Granger Causality Test Run on Egyptian CPI and Wage Data for the Period 1990-2005.

Table C.3.1. Summary of the Results

Direction of Causality	Number of Lags	Calculated F Value	Decision*
W_t-pub ➢ CPI_t	4	0.582	Do not reject H_0 **
CPI_t ➢ W_t -pub	4	0.0957	Do not reject H_0
W_t -prv ➢ CPI_t	4	3.223	Reject H_0
CPI_t ➢ W_t -prv	4	1.72	Do not reject H_0
W_t –pub ➢ CPI_t	8	0.899	Do not reject H_0
CPI_t ➢ W_t –pub	8	0.433	Do not reject H_0
W_t -prv ➢ CPI_t	8	0.4875	Do not reject H_0
CPI_t ➢ W_t –prv	8	2.1313	Reject H_0

* The decision is based on a tabulated F at a 5 percent level of significance.

** In this table and the following ones, the null hypothesis H_0 is: there is no causality running from the independent to the dependent; and the alternative hypothesis H_1 is: there is causality running from the independent to the dependent variable.

The results of the regression did not change after including the dummy variable accounting for devaluation.

[18] The annual averages for these variables are presented in Appendix A.

C.4. Results of the Granger Causality Test Run on Egyptian WPI and Wages Data for the Period 1994-2005.

Table C.4.1. Summary of the Results

Direction of Causality	Number of Lags	Calculated F Value	Decision*
W_t-pub ➢ WPI_t	4	0.11992	Do not reject H_0
WPI_t ➢ W_t –pub	4	0.32988	Do not reject H_0
W_t -prv ➢ WPI_t	4	1.76	Do not reject H_0
WPI_t ➢ W_t –prv	4	4.836	Reject H_0
W_t -pub ➢ WPI_t	8	0.4242	Do not reject H_0
WPI_t ➢ W_t -pub	8	0.3073	Do not reject H_0
W_t -prv ➢ WPI_t	8	1.213	Do not reject H_0
WPI_t ➢ W_t -prv	8	4.016	Reject H_0

* The decision is based on a tabulated F at a 5 percent level of significance.

The results above indicate that there is causality running from prices to private wages, whereas the public sector wages are not responsive to price inflation. Also, the results indicate that wage inflation in both sectors does not cause price inflation when measured by WPI. These results are measured at a 5 percent level of significance.

The results are consistent when using 4 or 8 lagged periods for both variables. These results are not sensitive to the inclusion of a dummy variable to account for the devaluation of the Egyptian pound starting 2001.

C.5. Results of the Granger Causality Test Run on the Rate of Change of the Egyptian Price Index of Clothing and Footwear and the Rate of Change of Wages Prevailing in the Manufacturing Sector for the Period 1995-2005.

Table C.5.1. Summary of the Results

Direction of Causality	Number of Lags	Calculated F Value	Decision*
W_t-pub ➢ PI of clothing & footwear	4	3.42	Reject H_0
PI of clothing & footwear ➢ W_t-pub	4	1.097	Do not reject H_0
W_t -prv ➢ PI of clothing & footwear	4	3.05	Reject H_0
PI of clothing & footwear ➢ W_t -prv	4	2.44	Reject H_0 at 10 percent significance level
W_t -pub ➢ PI of clothing & footwear	8	1.66	Do not reject H_0
PI of clothing & footwear ➢ W_t -pub	8	0.66	Do not reject H_0
W_t -prv ➢ PI of clothing & footwear	8	3.45	Reject H_0
PI of clothing & footwear ➢ W_t -prv	8	1.55	Reject H_0

* The decision is based on a tabulated F at a 5 percent level of significance, unless otherwise indicated.

The above table shows that wage growth in public and private manufacturing causes inflation in the prices of clothing and footwear, when considering 4 lagged periods of the variables. Using longer lags (8 lags) does not prove causality between public wages and prices, but the relationship remains significant for private sector wages and prices. The causality does not run in the opposite direction from price inflation to public sector wage inflation. However, when regressing change in private sector wages on change in prices of clothing and footwear, the relationship appears to be significant using 4 and 8 period lags, although the confidence level for the 4 period lags appears to be lower.

C.6. Results of the Granger Causality Test Run on Rate of Change of the Egyptian Price Index of Hotels and Restaurants and the Rate of Change of Wages Prevailing in the Same Sector for the Period 1995-2005.

Table C.6.1. Summary of the Results

Direction of Causality	Number of Lags	Calculated F Value	Decision*
W_t -pub ➢ H & R price growth	4	0.2	Do not reject H_0
H & R price growth ➢ W_t –pub	4	0.02	Do not reject H_0
W_t -prv ➢ H & R price growth	4	0.4	Do not reject H_0
H & R price growth ➢ W_t –prv	4	0.012	Do not reject H_0
W_t -pub ➢ H & R price growth	8	2.73	Reject H_0
H & R price growth ➢ W_t –pub	8	1.33	Do not reject H_0
W_t -prv ➢ H & R price growth	8	0.42	Do not reject H_0
H & R price growth ➢ W_t –prv	8	0.68	Do not reject H_0

* The decision is based on a tabulated F at a 5 percent level of significance.

Unlike the literature surveyed, which proposes that prices are more sensitive to wage inflation in the services sector, with special reference to the hotels and restaurants sector, the test conducted above concludes that—using 4 lagged periods—wage growth and price inflation of the hotels and restaurants services are independent from each other. When 8 lagged periods are used, causality has been noticed to work in the direction from wage growth to price inflation in the public sector, whereas the private sector wage growth remains independent from price changes in this service sector. It is worth drawing attention again to the unexpected behavior of wages in the hotels and restaurants sector, as referred to in Section 4 of this paper.

Conclusions

1. When the Granger causality test is run for 4 lagged periods (m=4, i.e., 1 year), the regression shows that there is independence between CPI_t and W_t-pub, whereas there is unidirectional causality running from W_t-prv to CPI_t, at a level of significance of 5 percent.
2. When the Granger causality test is run for 8 lagged periods (m=8, i.e., 2 years), the regression shows that there is still independence between CPI_t and W_t-pub, whereas unidirectional causality runs from CPI_t to W_t-prv.
3. Running the test using WPI as a measure of inflation reinforced the causality running from wage growth in the private sector to price inflation. This relationship does not change direction under the different lags used (4 and 8 lagged periods).
4. The relationship between price inflation and wage growth is much stronger in the manufacturing sector. Wage growth in both the private and public sectors causes price inflation. In addition, price inflation of the clothing and footwear group of products leads to wage inflation in the private manufacturing sector when using 4 lagged periods for the two variables.
5. The picture is totally different in the hotels and restaurants sector, where wage growth and price inflation are hardly related. Some causality appears from public sector wages to prices when using 8 lagged periods of the two variables at a 5 percent significance level. The unexpected behavior of the wage data provided on this sector puts a question mark on these results.
6. The inclusion of a dummy variable to account for the impact of devaluation, which started in 2001 and reached free floatation of the Egyptian pound by 2003, did not change the direction of causality or imply new relations on all levels of the analysis, general and sectoral.

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