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The Decline of Traditional Sectors in Israel: The Role of the Exchange Rate and the Minimum Wage

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Abstract

This paper examines the role of exchange rate appreciation and the minimum wage in the relative decline of traditional sectors in Israel. It finds little evidence to indicate that real exchange rate appreciation is primarily responsible for this decline. Rather, the evidence indicates that slower productivity growth in traditional sectors has led to relatively larger increases in unit labor costs compared with high-tech sectors. Although the links are only indicative, the evidence also suggests that the minimum wage has played a role in the relatively faster growth in unit labor costs.

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SUMMARY

This paper examines the role of exchange rate appreciation and the minimum wage system in the relative decline of traditional manufacturing sectors in Israel. During 1994–96, the output of high-tech sectors in Israel grew by 7.2 percent a year, whereas traditional sectors' output increased by 6.0 percent. Over the same period, exports from high-tech sectors grew by 9.0 percent a year while those of traditional sectors grew by 4.9 percent. The explanation for the relative decline of traditional sectors has been an important element of the recent policy debate in Israel. Many forces have come under scrutiny but exchange rate appreciation and the minimum wage system have received particular attention.

The paper finds little empirical evidence that the real appreciation of the Israeli shekel is primarily responsible for the long-term decline of traditional sectors relative to high-tech sectors, notwithstanding the objections of traditional sector exporters, who argue they would have been better off with a more depreciated exchange rate. In contrast, the evidence indicates that slower productivity growth in the traditional sectors has led to relatively sharper increases in unit labor costs compared with high-tech sectors. Although the links are only indicative, the evidence also suggests that the minimum wage has played a role in this relatively faster growth in unit labor costs. Reforming the minimum wage system to promote greater scope for changes in relative wages across sectors could be one way to slow the decline of traditional sectors.

I. INTRODUCTION

During 1994–96, the output of high-tech sectors in Israel grew by 7.2 percent per annum whereas traditional sectors' output increased by 6.0 percent. Over the same period, exports from high-tech sectors grew by 9.0 percent per annum while those of traditional sectors grew by 4.9 percent.[2] The explanation for this relative "decline" of traditional sectors has been a subject of debate in Israel. Many contributing factors have been identified but exchange rate appreciation and the minimum wage system have received particular attention. Exporters of traditional products have been complaining that real exchange rate appreciation has damaged their competitiveness. As one analysis of the situation put it:

> "The currency appreciation . . . has also been harmful, chiefly to the traditional industries and small enterprises, which have to contend with a given world price—for an export product or an import substitute—to which they are increasingly exposed because of the [trade] liberalization process. The high-tech sectors, in contrast, enjoy greater flexibility because several Israeli high-tech firms have taken over world niches and are able, to some extent, to set their own prices."[3]

Regarding the minimum wage system, many news articles have reported statements by some policy makers contending that it has played an important role in the decline of traditional sectors. A sample of the debate can be gleaned from postings on the website of *Globes*, a leading financial newspaper in Israel. One article reported that Bank of Israel Governor Jacob Frenkel was unequivocally opposed to any raising of the minimum wage and criticized the present level of the wage, noting that it was driving manufacturing from Israel.[4] Another article reported that Industry and Trade Minister Sharansky had said, "There is no doubt that the minimum wage is relatively high, and greatly affects the profitability of enterprises, and also export profitability."[5] Another article noted that Ministry of Finance officials had stressed that the first firms to be affected by minimum wage increases were in the labor intensive sectors, such as wood, textiles and food industries.[6]

This paper examines the role of exchange rate appreciation and the minimum wage system as factors behind the decline of traditional manufacturing sectors in Israel. The next section

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[2]*Bank of Israel Annual Report*, 1996.

[3]*Economic Outlook*, State of Israel Ministry of Finance, Economic Research and State Revenue Division, October 1997.

[4]*Globes* website (2/17/98).

[5]*Globes* website (2/18/98).

[6]*Globes* website (2/18/98).

clarifies the definition of "decline," and the subsequent section discusses in further detail how the exchange rate and the minimum wage system may have contributed to it. The next section looks at some evidence and the final part contains a few concluding observations.

In general, it is found that based on the data examined in this paper, there is little empirical evidence that the real appreciation of the Israeli shekel should be held primarily responsible for the long-term decline of traditional sectors relative to high-tech sectors, notwithstanding that from the perspective of traditional sector exporters they would have been better off with a more depreciated exchange rate. In contrast, the evidence indicates that slower productivity growth in the traditional sectors has led to relatively sharper increases in unit labor costs compared with high-tech sectors. The evidence also suggests that the minimum wage has been a factor behind this relatively faster growth in unit labor costs. Of course, other factors have likely also played important roles and they are briefly discussed. The findings in this paper suggest that the reform of the minimum wage system to promote greater scope for changes in relative wages across sectors could be one way to slow the decline of traditional sectors without introducing distortions.

II. The Decline of Traditional Sectors

This section elaborates on what is meant by "the decline of traditional sectors." First, there is the issue of defining "traditional sectors." Other terms used for these sectors are "labor intensive" or "less-human-capital intensive" to contrast them from high-tech sectors which are sometimes called "human-capital intensive." In this paper, the terms "traditional" and "high-tech" will be used for simplicity. Bregman et al (1991) develop a methodology to define high-tech firms using a technology index based on 1982 data on the use of skilled labor, physical capital, and R&D in each sector, finding that high-tech firms produce the majority of output in the electronics, transport equipment, metal, chemical, and mineral sectors. Under their classification system, lower tech firms are relatively more likely to be part of the food, beverages, and tobacco sector and the textiles and clothing sector.

In the analysis below, the traditional sector is defined to include clothing, textiles, food, beverages, and tobacco.[7] Other sectors sometimes considered as traditional, such as wood products, are omitted because of problems with data coverage. The high-tech sector is defined in this paper to include machinery and equipment, metal products, and assorted electronic equipment.[8]

The second issue is to define "decline." Looking at the numbers cited above, it is difficult to claim that traditional sectors are in a long-term decline in an absolute sense, although their

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[7]See the Data Appendix for details on the sources and coverage of the data used in this paper.

[8]*Bank of Israel Annual Report*, 1996, uses a similar classification.

position did deteriorate significantly in 1996 (e.g., output of these sectors grew by only 1.1 percent and exports fell by 1.5 percent).[9] Thus, the decline is in relative rather than absolute terms. However, relative decline can be shown by different forms of comparison: against a counterfactual of what would have happened if some inhibiting factor (such as exchange rate appreciation, for example) were not present or against other sectors such as high-tech. News articles suggest that the debate in Israel concerns both concepts.[10] One could argue that the former concept should be more important for manufacturers since it would indicate that their profits were being hurt. However, given a lack of information on the counterfactual situation, it is not possible to examine this case directly. The alternative would be to estimate a fully specified model describing the relationship between firms' profitability and factors such as the exchange rate and the minimum wage. Given the large data demands that such an exercise would involve and the uncertainties that would be introduced by the necessity to make many simplifying assumptions, this approach is not taken in this paper. Instead, here traditional sectors are examined relative to high-tech sectors.

Developments in traditional and high-tech sectors can be compared, *inter alia*, on the basis of factor inputs, production, exports, and profitability. Figures 1 to 3 show developments in the traditional and high-tech sectors and total industrial production during 1987 to 1997. It is clear that over the period as a whole the growth of output, exports, and the use of man power fell behind in the traditional sector relative to the high-tech sector. This trend was particularly evident for exports starting in 1993 and, for output and man-hours worked, starting in 1994. Time series on profitability by sector are not available. Looking at cross sectional data for 1982, Bregman et al (1991) find that high-tech firms are more productive, pay higher wages, earn higher rates of return and are more export-oriented than firms in other sectors.

III. Possible Factors Behind Traditional Sectors' Decline

This section discusses in further detail how real exchange rate appreciation and the minimum wage system may have contributed to the decline of traditional sectors as defined above. Other possible explanations are also briefly considered.

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[9] *Bank of Israel Annual Report*, 1996.

[10] For an example of the debate concerning the comparison between traditional and high-tech sectors, an article on the *Globes* website (2/24/98) reports that an official of the Manufacturers' Association claimed that the Finance Ministry was only concerned about the high-tech sectors.

A. The Minimum Wage System

The Israeli Knesset approved a law in March 1987 regulating the minimum wage in Israel. Before this time, the minimum wage was the result of agreements between labor unions and an employers' confederation.[11] The new law established that the minimum wage would be updated according to cost-of-living allowances and general wage increments which are stipulated in general collective agreements. To prevent the minimum wage from eroding over time, the law also established that the minimum wage would be updated once annually, on April 1, so that it would correspond to at least 45 percent of the average wage in the economy. In March 1997, this ratio was raised to 47.5 percent. As would be expected given this law, the average wage and the minimum wage track one another very closely (Figure 4).

As for the details of the minimum wage law, it specifies that the reference wage for the April 1 adjustments is the average wage during the three most recent months for which data are available. However, in practice until April 1997, the minimum wage was adjusted to exactly 45 percent of the average wage only every other year. During interim years the adjustment was by the CPI. In any case, out of a sample of ten annual adjustments under the procedures in the law, eight were greater than or equal to the amount given by applying 45 percent (and later 47.5 percent) to the April average wage. The increase in the minimum wage takes effect immediately but the law stipulates that the immediate increase in the average wage due to the increase in the minimum wage should not have second round effects on the minimum wage.

How could this system drive up wages in the traditional sectors? This could come about if wage increases in sectors with relatively higher productivity growth (e.g., high-tech) lead to increases in the average wage which then translate into wage increases in sectors with lower productivity growth (e.g., traditional). This effect would be exacerbated if the sectors with relatively lower productivity growth also employ a relatively higher percentage of minimum wage workers. With rising unit labor costs, firms in traditional sectors will find their profits squeezed and have greater difficulty competing in export markets. The relative impact on the traditional sector would also be aggravated to the extent that these firms are more price-takers than firms in the high-tech sector.

B. Exchange Rate Appreciation

Israel's real effective exchange rate, as measured by relative consumer prices, appreciated by some 22 percent from 1987 to 1997 with a sharp upward movement in the rate coming after mid-1995 (Figure 5). As noted above, the view has been expressed that this real appreciation

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[11]Flug and Kasir (1994) find that the enactment of the minimum wage law in 1987 significantly strengthened the enforcement of the minimum wage. Nevertheless, anecdotal reports suggests that enforcement remains relatively low. Similarly, Luski and Weinblatt (1997) note that under the old system there was no effective enforcement.

has adversely affected traditional sectors to a greater extent than high-tech sectors in part because traditional sector firms are more likely to be price takers and are thus less able to insulate themselves from the effects of exchange rate appreciation.[12] In this case, exchange rate appreciation would put a squeeze on the profits of traditional firms, hastening their decline.[13] On a related topic, De Fiore (1998) finds that while the exchange rate channel is an important mechanism for the transmission of monetary policy in Israel for sectors exposed to trade, those sectors with a relatively high value added and a low wage share (such as high-tech) appear to be able to partially insulate themselves from the effects of exchange rate appreciation.

C. Other Possible Factors

While they have received less attention in the recent policy debate (and are beyond the scope of this paper), at least four other possible reasons could be advanced for the decline of traditional sectors. The first is trade liberalization. Since September 1991, Israel has been progressively lowering tariff rates applicable to trade with countries with which Israel does not have free trade agreement.[14] By September 1996, the maximum tariff rate was 12 percent for all finished and intermediate goods except textiles, footwear, and clothing, plywood, and glass sheets where the maximum rate was 42 percent. While, as a generalization, one could say that tariff protection is still higher for the traditional sectors, the reductions that have taken place appear to have led to sharp increases in import volumes in traditional sectors. The theoretical argument that trade liberalization will force imperfectly competitive domestic industries to price more competitively is well established and Hakura (1998) provides empirical support for this proposition in her study of six manufacturing industries in six EU countries.[15] Thus, trade liberalization could be helping to erode the profitability of traditional firms and contributing to their decline.

Second, Bregman et al (1991) note that "As an additional part of its industrial strategy, the Israeli government provides financial incentives for R&D projects designed to expand exports, which, given the interface between high technology, R&D investment, and export-orientation,

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[12]In a study of the effects of exchange rate fluctuations in G7 countries, Burgess and Knetter (1996) make a similar point.

[13]For example, the President of the Israeli Manufacturers' Association has been quoted as saying that because of currency appreciation, export profitability has been eroded by 25 percent in the past four years (*Globes* website (8/7/97)) .

[14]International Monetary Fund, "Israel—Selected Issues and Statistical Appendix," *IMF Staff Country Report No. 97/2*, February 1997.

[15]See Helpman and Krugman (1989) for the theoretical argument.

is a source of subsidy primarily used by high-tech firms." These subsidies could be putting traditional sectors at a disadvantage relative to high-tech sectors and hastening their decline.

Third, some speculate that there is a global glut in labor-intensive manufactured exports. If true, this would hurt the exports of Israel's traditional sectors.

Fourth, it is sometimes noted that Israel's "end-of-the-line" status for air and sea links given the level of economic relations with neighboring countries; small population; and distance from export markets may dampen exports of products, particularly the bulkier ones produced by traditional sector firms.[16]

IV. THE EVIDENCE

The first issue to examine is the relationship between the minimum wage and wages in the various sectors. Following the implementation of the minimum wage law, the increase in real wages was particularly notable in those sectors employing a large number of low-wage earners. In 1987, the real wage went up 21 percent in the food, beverages and tobacco sector and 18 percent in the textiles, apparel and leather sector in contrast to gains of 12 percent in the metals and machinery sector and 15 percent in the electronics and transport equipment sector.[17] However, over the period 1988–97 as a whole, the minimum wage and the average sectoral wages moved very closely together (Figure 6) and disentangling cause and effect is very difficult as even percentage changes are highly correlated (e.g., the correlation coefficient between percentage changes in the minimum wage and the average wage in the traditional sector is 0.78 and between the minimum wage and the high-tech sector it is 0.51).[18] As noted above, the minimum wage is determined in part by the average wage in the economy and the high-tech and traditional sectors as defined here account for approximately 37 and 18 percent

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[16]For example, see Oxford Analytica Brief website (1/21/98 and 1/22/98), "Israel: Knowledge-Based Economy".

[17]*Bank of Israel Annual Report*, 1988.

[18] Luski and Weinblatt (1997) study the impact of the introduction of the minimum wage. Using 1983 census data on wage distribution, they estimate that the effect of the minimum wage on firms in the food, beverages, tobacco, textiles and clothing sectors would be greater than that on the average industrial firm while the effect on firms in the machinery and electrical equipment sectors would be less. They estimate that the metal products sector would be affected somewhat more than average but still to a far lesser degree than the sectors classified here as traditional. Using data for 1986 and 1990, they conclude that the introduction of the minimum wage caused a decrease in labor demand and supply. However, in their econometric estimates they do not take account of sharp slowdown in the Israeli economy in 1988–89.

of industry, respectively. So, over the long run, causation runs both from the sectoral wages to the minimum wage as well as from the minimum wage to the sectoral wages.

In addition to problems of disentangling causation between the minimum wage and the sector average wages, these variables are also driven by common exogenous factors such as cost-of-living and general wage adjustments. For example, throughout the period under consideration, the use of wage indexation was widespread. While the exact formula changed over the years, wages were typically linked to some 85 percent of past consumer price inflation above a threshold level. Thus, of the increase in the minimum wage between March 1987 and October 1997, about 100 percentage points were due to cost-of-living and general salary adjustments and 155 percentage points were due to the adjustments to maintain the relationship with the average wage.

Notwithstanding these problems, it is nonetheless interesting to attempt an econometric examination of the relationships between the sectoral wages and the minimum wage. Table 1 lists first order augmented Dickey-Fuller tests, ADF (1), for the minimum wage, the sectoral wages, sectoral labor productivities and the price level.[19] As would be expected from a cursory examination of Figures 6 and 7, these variables are non-stationary. Except for the average wage in the high-tech sector, the ADF (1) tests indicate that all the variables have stationary first differences.[20]

Tables 2a and 2b report cointegration analyses of the long-run relationships among the integrated variables for the traditional sector based on Johansen's procedure.[21] No significant evidence of cointegrating relationships for the high-tech sector was found as would be expected given that the minimum wage is not binding on the average worker in the high-tech sector. Tests were first done assuming that there would be a long-run relationship between the sectoral wage, the minimum wage, sectoral labor productivity, and the price level (due to indexation). As can be seen in Table 2a, the maximal eigenvalue and trace eigenvalue statistics (λ_{max} and λ_{trace}) reject the null hypothesis of no cointegration in favor of at least one cointegrating relationship and no evidence exists for more than one. The first row of β' is the estimated cointegrating vector. Except for prices, the signs of the coefficients are as expected. However, tests for the significance of the variables in the cointegrating vector indicate that prices and labor productivity are not significant. Tests also indicate that, individually and jointly, prices and labor productivity are weakly exogenous in the cointegrating vector.

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[19]See de Brouwer and Ericsson (1995) for a similar analysis of cointegration and details on the test statistics. See also Doornik and Hendry (1997) for an explanation of cointegration tests.

[20]Graphical analysis suggests that the average wage in the high-tech sector is also I(1) and its ADF (1) test is significant at the 10 percent level.

[21]See Doornik and Hendry (1997).

Given the lack of significance of labor productivity and prices in the cointegrating relationship, Table 2b reports a cointegration analysis of the long-run relationship between the sectoral wage and the minimum wage. First, the eigenvalue statistics reject the null hypothesis of no cointegration in favor of one cointegrating vector. The coefficient on the minimum wage in that vector is of the correct sign and the coefficients in the first column of α, which measure the feedback effect of the (lagged) disequilibrium in the cointegrating relation onto the variables, are of the expected sign and suggest that the feedback affects the minimum wage more strongly than the sectoral wage. The minimum wage and the sectoral wage are both significant in the cointegrating relationship and the stationarity of these variables is rejected, consistent with the results in Table 1. Finally, neither the minimum wage nor the sectoral wage is weakly exogenous, so further analysis of the relationship between them must use a systems approach.

A full-fledged estimation of a model of the short-run dynamics of the relationship between the minimum wage and the sectoral wage is beyond the scope of this paper. Nevertheless, Table 3 presents a reduced version of such a model, which gives a flavor of the dynamics that may be involved. Consistent with the estimation in Table 2b, this model suggests that the feedback of a (lagged) disequilibrium between the nominal wage and the minimum wage is through the minimum wage and that increases in the minimum wage have a contemporaneous effect on the nominal wage.

Given numerous simplifying assumptions in constructing the data (see the Data Appendix for details) and the likelihood that not all variables determining wages have been taken into consideration, these empirical results should be viewed as suggestive rather than definitive. However, they do add to the graphical analysis and the calculation of simple correlation coefficients referred to above. To summarize the evidence so far, since the introduction of the minimum wage, which initially had a greater impact on the level of wages in the traditional sector than in the high-tech sector, the wage indexation system and the minimum wage system have tended to cause wages in both sectors to change at similar rates, partly established on an economy-wide basis and not necessarily related to developments in labor productivity in individual sectors.[22] Preliminary statistical analysis suggests that the minimum wage has also played a greater role in the determination of wages in the traditional sector than in the high-tech sector over the entire period being examined.

Moving on to labor productivity, its growth in the traditional sector over the last decade fell behind that in the high-tech sector by 13 percentage points, with much of the difference occurring during 1988–90 (Figure 7). Israel went through a period of very slow GDP growth

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[22]This discussion refers to the changes in wages and labor productivity. Regarding the levels of wages in the various sectors, Bregman et al (1992) conclude that there is a statistically significant relationship between labor productivity and wages. They note, for example, that wage rates appear to be higher in the electronics industry than in other sectors, particularly food and tobacco and textiles. Flug and Kasir (1993) report a similar finding.

in the first two of those years and rising unemployment in all three. Both traditional and high-tech sectors responded to the lower domestic demand by cutting back on the use of labor (Figure 3). However, in the case of the high-tech sector, the reduction in labor input was offset by higher labor productivity and so output did not decline (Figure 1). The stronger growth of labor productivity during 1988-90 in the high-tech sector would appear to have been the result of relatively higher investment in that sector, particularly in R&D, over a number of years. For example, R&D expenditures in 1985 as a proportion of the sector's value added were 0.3 percent in the food, beverages and tobacco sector, 0.2 percent in the textiles, apparel and leather sector, 1.8 percent in the metals and machinery sector and 16.9 percent in the electronics and transport equipment sector.[23] In 1987, the capital stock per worker in local currency terms in the food, beverages and tobacco sector was NIS 52,000 and in the textiles, apparel, and leather sector it was NIS 47,000, while in the metal, electronics and transport equipment sector it was NIS 125,000.[24] Since 1991, labor productivity growth in the traditional sector has kept pace with that in the high-tech sector (Figure 7); nevertheless, the prior cumulative deterioration in relative productivity would have still tended to put the traditional sector at a competitive disadvantage vis-a-vis the high-tech sector.

Taking into consideration the developments in wages and labor productivity described above, estimates of unit labor costs (ULC) can be derived. Over the period 1987 to 1997, ULC in the traditional sector rose by 11 percent more than in the high-tech sector (Figure 8). Abstracting for the moment from the prices at which the products from these sectors could be sold, it is clear that the relatively faster rate of increase in ULC would have put pressure on the profitability of traditional sector firms. The causes for the sharper rise in ULC cannot be determined precisely but it is clear arithmetically that this difference was largely driven by slower growth in labor productivity while the wage indexation system and the minimum wage system kept the changes in nominal wages from diverging very much from one another in the two sectors.

In determining profitability, firms' costs can be compared either with domestic or foreign prices or both. Given that Israel is a small, open economy, and that export markets are important for both traditional and high-tech firms, the point of comparison used here is the market for exports.[25] Figure 9 shows data on export prices in dollars for total industrial production and the traditional and high-tech sectors. The dollar prices faced by traditional firms' exports grew rapidly during the period 1987–89 relative to those faced by high-tech

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[23] *Bank of Israel Annual Report*, 1988.

[24] *Bank of Israel Annual Report*, 1988.

[25] It is possible to look at either import or export prices. Using aggregate data on export and import prices to calculate real exchange rates shows little difference (See *Bank of Israel Annual Report*, 1998 (Hebrew)). Data by disaggregated sector were available only for export prices.

firms (the relative difference was 22 percent from the first half of 1987 to the first half of 1990). For the decade as a whole, dollar export prices rose by some 25 percent more in the traditional sector than in the high-tech sector.

Combing the data on export prices (in shekels) and ULC, real exchange rates can be calculated for the individual sectors (Figure 10).[26] From 1987 to 1997, the real exchange rate for the traditional sector appreciated by about 11 percent less than that for the high-tech sector. Most of this difference came about after 1994 when the real exchange rate in both sectors appreciated sharply and the exports of the traditional sector started to decline relative to those of the high-tech sector. While it is intuitive that the real appreciation hurt the competitiveness of the traditional sector, Figure 10 suggests that the appreciation should have impacted the high-tech sector even more. The claims of exporters in the traditional sector that they were suffering more from real exchange rate appreciation than high-tech exporters does not appear to be supported by the data. Of course, total factor productivity growth in the high-tech sector would have help alleviate the pain. In summary, over the decade as a whole, export prices in dollars as transmitted by the exchange rate should have—in relative terms—supported rather than hindered the traditional sector. The steady increase in labor costs over the decade relative to productivity gains appears to have been a more important source of the faltering competitiveness of the traditional sector.

V. Concluding Observations

The evidence considered above suggests that the transformation of the Israeli economy from one based on traditional exports to one increasingly based on high-tech exports is not primarily the result of exchange rate movements. At the same time, the functioning of the minimum wage system—in combination with the wage indexation scheme—appears to have reduced the scope for changes in relative wages between sectors to account for differences in productivity growth. This has meant that since the time the minimum wage system was instituted in early 1987 there has been a steady relative increase in the unit labor costs of the traditional sector. However, this increase in relative unit labor costs in recent years has not been extremely large, especially taking into consideration developments in export prices. This suggests that other factors, such as trade liberalization and developments in international product markets, may have also played a role in the relative decline of the traditional sector, particularly during the period after 1991 when differences in productivity growth between the sectors were small.

Regarding policy implications, the evidence considered suggests that reforms to the minimum wage system that increased the scope for relative wage changes between high and low productivity sectors would be a policy that would tend to help the traditional sector. Beyond Israel, this conclusion would likely also be true for other countries which use minimum wage legislation to pursue an egalitarian distribution of income.

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[26]See Clifton (1985) for a discussion of sectoral real exchange rates.

DATA

The data in this paper are taken from various issues of *International Financial Statistics*, publications of the State of Israel, Central Bureau of Statistics and reports of the Bank of Israel and the Ministry of Finance.

Unit labor costs (ULC) are calculated by using indices of paid hourly labor costs, industrial production, and man-hours worked. The sectoral real exchange rates are calculated by taking ratios of ULC to indices of export prices in shekels (see Clifton (1985) for further information on calculating sectoral real exchange rates).

Data on industrial production, man-hours worked, and paid hourly labor cost used in this paper come from various issues of the *Monthly Bulletin of Statistics* published by the State of Israel, Central Bureau of Statistics for the period 1987 to 1997. In addition to data for the entire industrial sector, data are used for the following sectors: Food, Tobacco Products, and Beverages; Textiles and Wearing Apparel; Metal Products; Machinery and Equipment; and, Electric Motors, Electronic Components, and Equipment and Other Equipment. Adjustments are made to account for changes in sectoral classifications and data definitions over time. In addition, the weights used in the *Bulletin* to construct the various indices changed in 1989 and 1994, creating series breaks in those years (e.g., see *Monthly Bulletin of Statistics*, Volume XLI, Number 12, December 1990 for details). The quantitative impact of the change in the weights on the data used in this paper does not appear to be large.

Data on industrial export prices and volumes are taken from various issues of *Foreign Trade Statistics Quarterly* published by the State of Israel, Central Bureau of Statistics for the period 1987 to 1997. In addition to data for total industrial exports, data are used for the following sectors: Food and Beverages; Textiles, Clothing, and Leather; Basic Metal and Metal Products; Machinery and Equipment; Electronic Components, Office Machines, and Computers; Communications Equipment, Control Equipment, and Medical and Scientific Equipment. In the early part of the period studied, data for the last four categories are available only in the aggregate category Metal, Machinery, and Electronics. The sector classification from *Foreign Trade Statistics Quarterly* does not match up exactly with that in the *Monthly Bulletin of Statistics.*

Table 1. ADF(1) Statistics for Testing for a Unit Root 1/

	Variable					
	Min. Wage	Trad. Wage	High-Tech Wage	TR LP	HT LP	Prices
I(1)	-2.049 (-0.172)	-1.884 (-0.172)	-2.405 (-0.155)	-2.431 (-0.362)	-3.116 (-0.402)	-1.112 (-0.052)
I(2)	-4.136 ** (-0.782)	-4.082 ** (-0.959)	-2.797 (-0.642)	-4.922 ** (-1.305)	-5.807 ** (-1.465)	-3.276 * (-0.648)
I(3)	-5.274 ** (-1.643)	-5.987 ** (-1.778)	-5.727 ** (-1.891)	-7.105 ** (-2.034)	-8.448 ** (-2.115)	-8.022 ** (-1.890)

1/ The top number in each row is the augmented Dicky-Fuller statistic, ADF(1), and (in parentheses) the estimated coefficient on the lagged variable. The estimation period is 1988(1)–1997(4). Estimated using PcGive 9.0.

* Implies significance with a 95 percent critical value.
** Implies significance with a 99 percent critical value.

Table 2a. Cointegration Analysis of the Traditional Sector Wage 1/

Eigenvalue	0.650	0.292	0.211	0.010	
Null hypothesis	r = 0	r ≤ 1	r ≤ 2	r ≤ 3	
λ_{max}	42.0**	13.8	9.5	0.4	
λ_{max}^{adj}	33.6**	11.6	7.6	0.3	
95% critical value	27.1	21.0	14.1	3.8	
λ_{trace}	65.7**	23.7	9.9	0.4	
λ_{trace}^{adj}	52.6*	18.9	7.9	0.3	
95% critical value	47.2	29.7	15.4	3.8	
		Standardized adjustment coefficients α			
Sector wage	0.133	0.054	-0.095	-0.023	
Minimum wage	0.485	-0.049	-0.047	-0.006	
Labor productivity	-0.124	-0.103	-0.391	-0.021	
Prices	0.125	0.107	-0.156	0.011	
		Standardized eigenvectors β′			
	Sector Wage	**Min. Wage**	**Labor Prod.**	**Prices**	
	1.000	-0.860	0.385	-0.254	
	-1.547	1.000	1.310	0.209	
	-0.760	0.082	1.000	0.537	
	-0.396	-0.642	0.129	1.000	
		Weak exogeneity test statistics			
					{Labour prod., Prices}
$\chi^2(1)$ 2/	6.27*	26.34**	1.44	3.65	4.70
		Multivariate statistics for testing stationarity			
$\chi^2(3)$	30.42**	29.87**	33.63**	28.96**	
		Statistics for testing the significance of a given variable			
$\chi^2(1)$	9.87**	16.90**	1.69	1.85	

1/ The vector autoregression includes two lags on each variable in logarithmic form, a constant term, and quarterly dummies. The estimation period is 1988(1) to 1997(4). Estimated using PcFiml 9.0.
2/ The joint test is $\chi^2(2)$.

* Implies significance with a 95 percent critical value.
** Implies significance with a 99 percent critical value.

Table 2b. Cointegration Analysis of the Traditional Sector Wage 1/

Eigenvalue	0.400	0.024
Null hypothesis	$r = 0$	$r \leq 1$
λ_{max}	20.4**	1.0
λ_{max}^{adj}	18.4**	0.9
95% critical value	14.1	3.8
λ_{trace}	21.4**	1.0
λ_{trace}^{adj}	19.3*	0.9
95% critical value	15.4	3.8
	Standardized adjustment coefficients α	
Sector wage	0.121	0.243
Minimum wage	0.431	-0.011
	Sector wage	**Minimum wage**
	Standardized eigenvectors β'	
	1.000	-1.064
	-1.127	1.000
	Weak exogeneity test statistics	
$\chi^2(1)$	5.47*	18.55**
	Multivariate statistics for testing stationarity	
$\chi^2(1)$	15.76**	14.57**
	Statistics for testing the significance of a given variable	
$\chi^2(1)$	14.57**	15.76**

1/ The vector autoregression includes two lags on each variable in logarithmic form, a constant term, and quarterly dummies. The estimation period is 1988(1) to 1997(4). Estimated using PcFiml 9.0.

* Implies significance with a 95 percent critical value.
** Implies significance with a 99 percent critical value.

Table 3. Model of the Traditional Sector Wage 1/

Identity for cointegrating vector CI:

CI_1	1.0000
DLNW.TR	1.0000
DLMINWAG	-1.0639

Equation 1 for DLNW.TR (First difference of traditional sector wage as log)

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE
DLMINWAG	0.27068	0.11736	2.306	0.0271	0.13609
Constant	0.02686	0.00386	6.961	0.0000	0.00502

$\sigma = 0.01057$

Equation 2 for DLMINWAG (First difference of minimum wage as log)

Variable	Coefficient	Std.Error	t-value	t-prob	HCSE
DLNW.TR_1	-0.50347	0.24445	-2.060	0.0469	0.21808
CI_1	0.43380	0.09184	4.724	0.0000	0.14694
Constant	0.16136	0.03298	4.894	0.0000	0.04837

$\sigma = 0.01880$

Loglik = 347.28387 $\log|\Omega| = -17.3642$ $|\Omega| = 2.87625e\text{-}008$ $T = 40$
LR test of over-identifying restrictions: $\chi^2(3) = 0.282342$ [0.9633]

Correlation of residuals:

	DLNW.TR	DLMINWAG
DLNW.TR	1.0000	
DLMINWAG	-0.22325	1.0000

1/ Estimated using PC-FIML 9.0. The present sample is: 1988 (1) to 1997 (4); Seasonal dummies not reported.

Figure 1. Industrial Production
(1994=100)

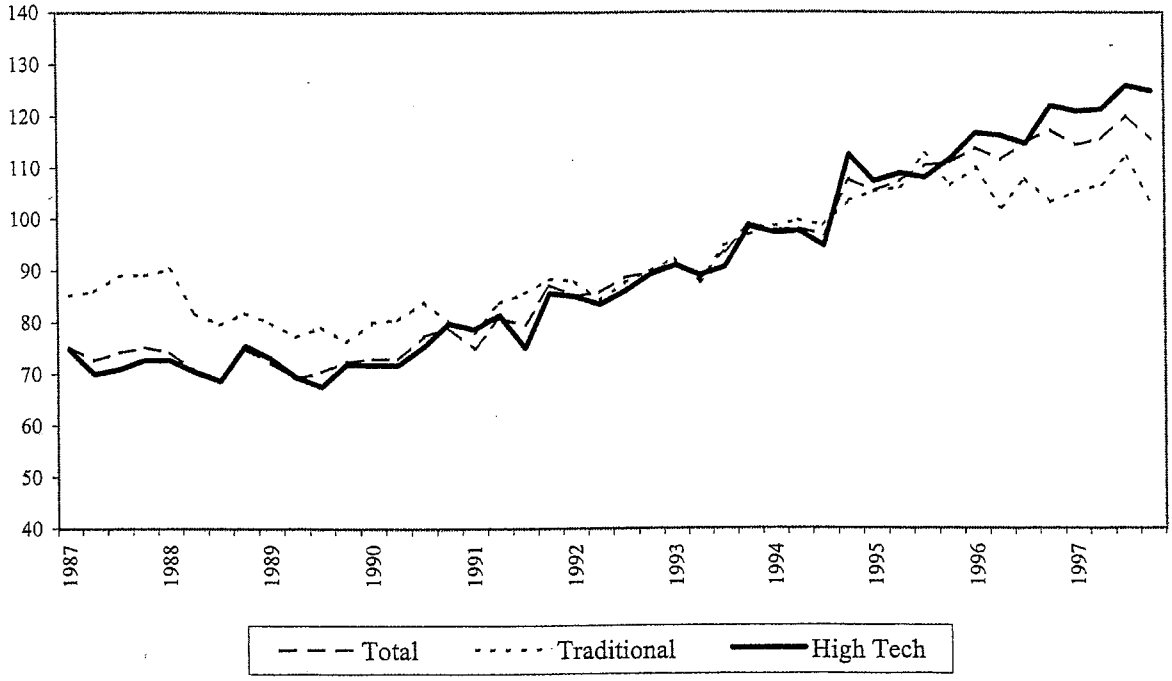


Figure 2. Export Volume
(1994=100)

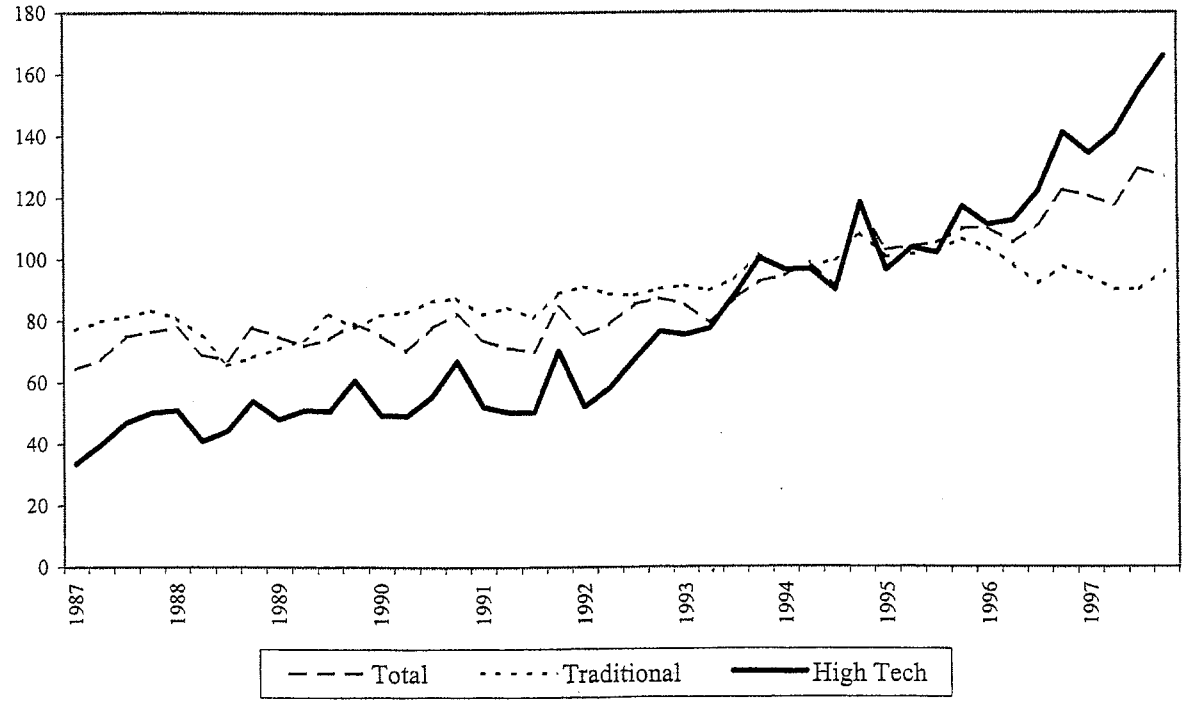


Figure 3. Man-hours Worked
(1994=100)

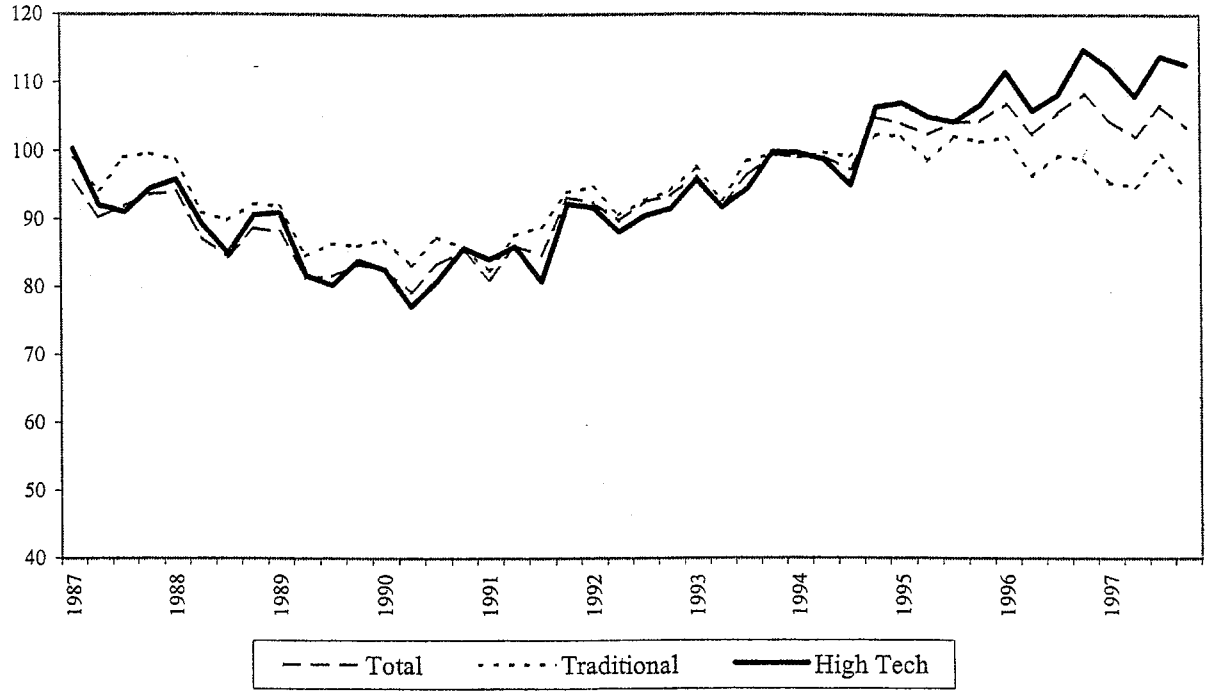


Figure 4. Average Wage and Minimum Wage
(New Israeli Sheqalim)

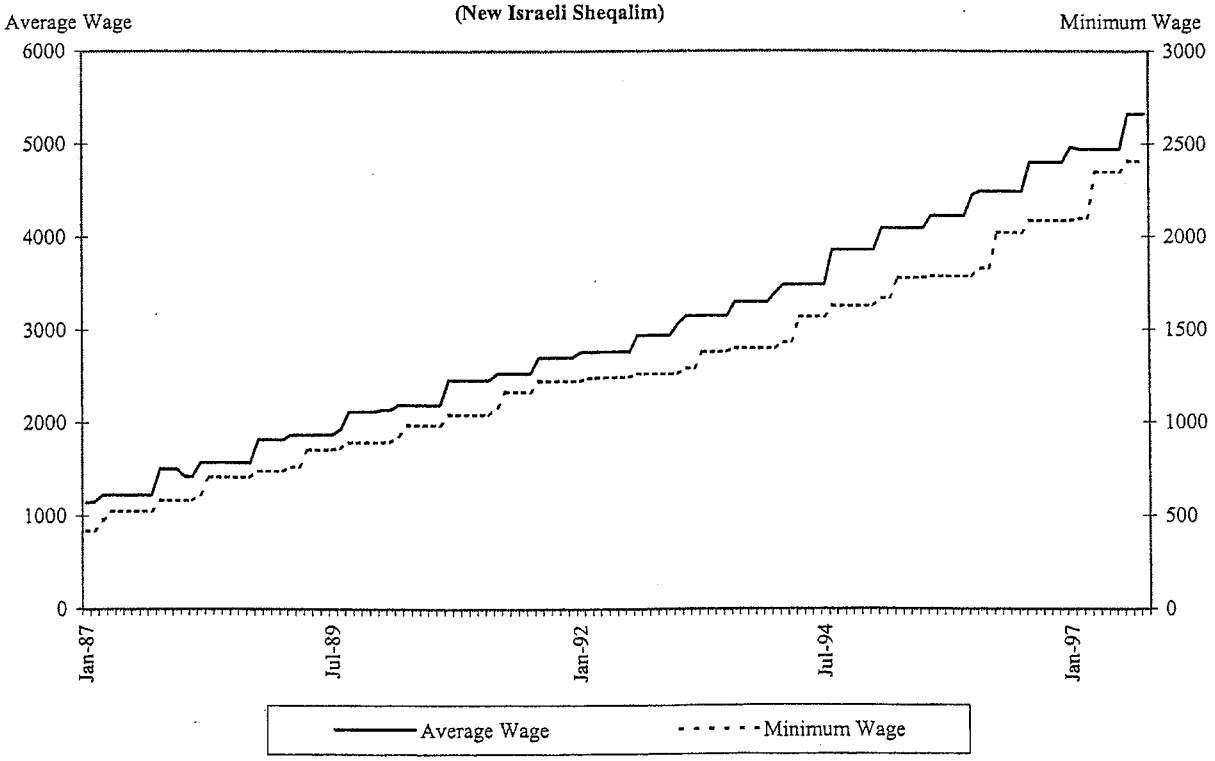


Figure 5. Real Effective Exchange Rate
(CPI based; 1994=100)

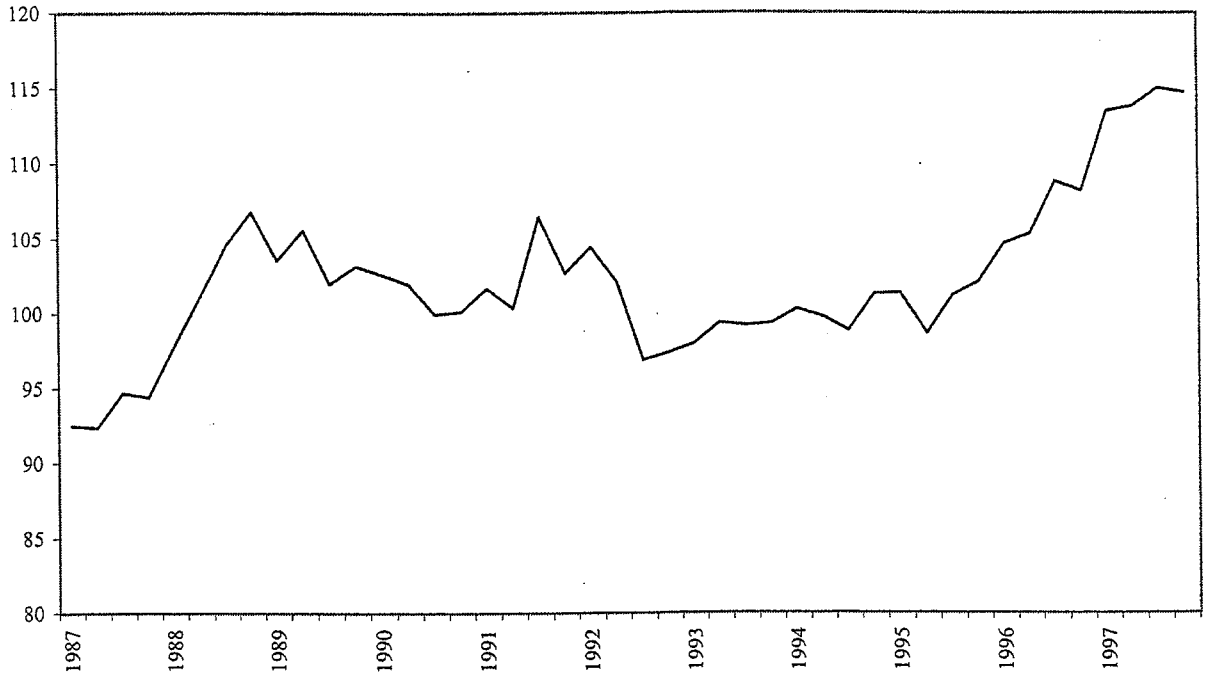


Figure 6. Wages
(1994=100)

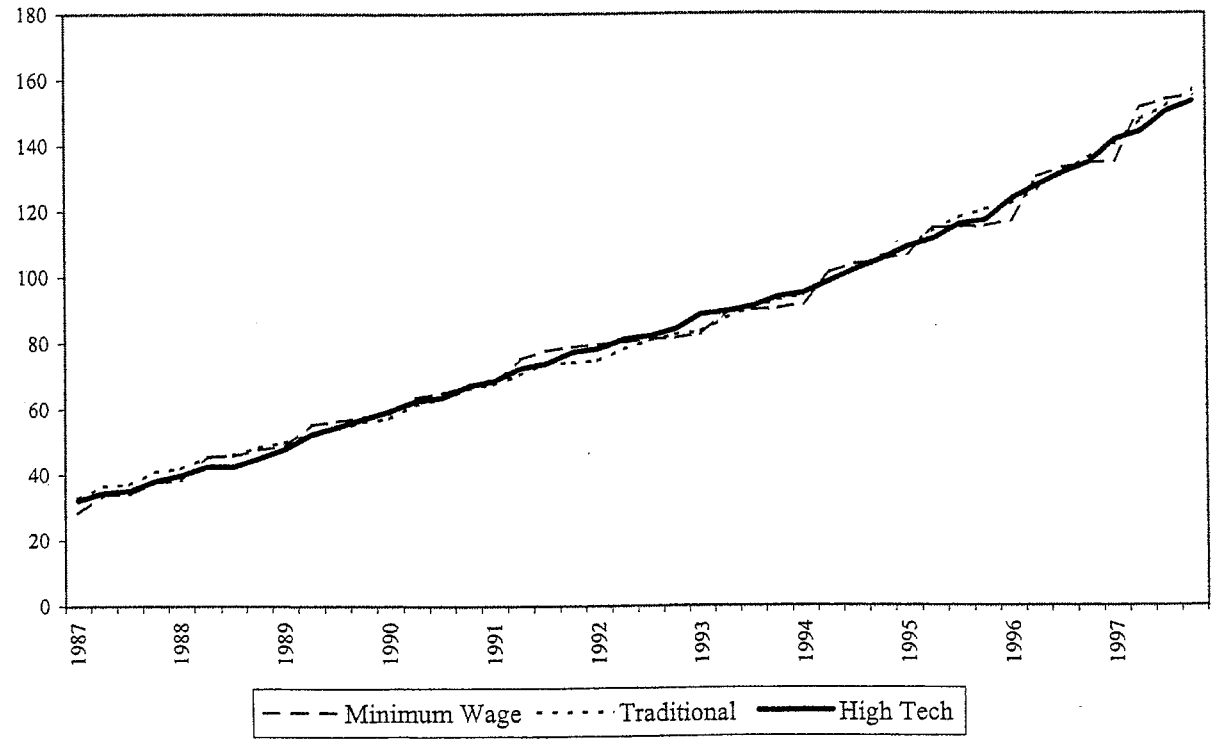


Figure 7. Labor Productivity
(1994=100)

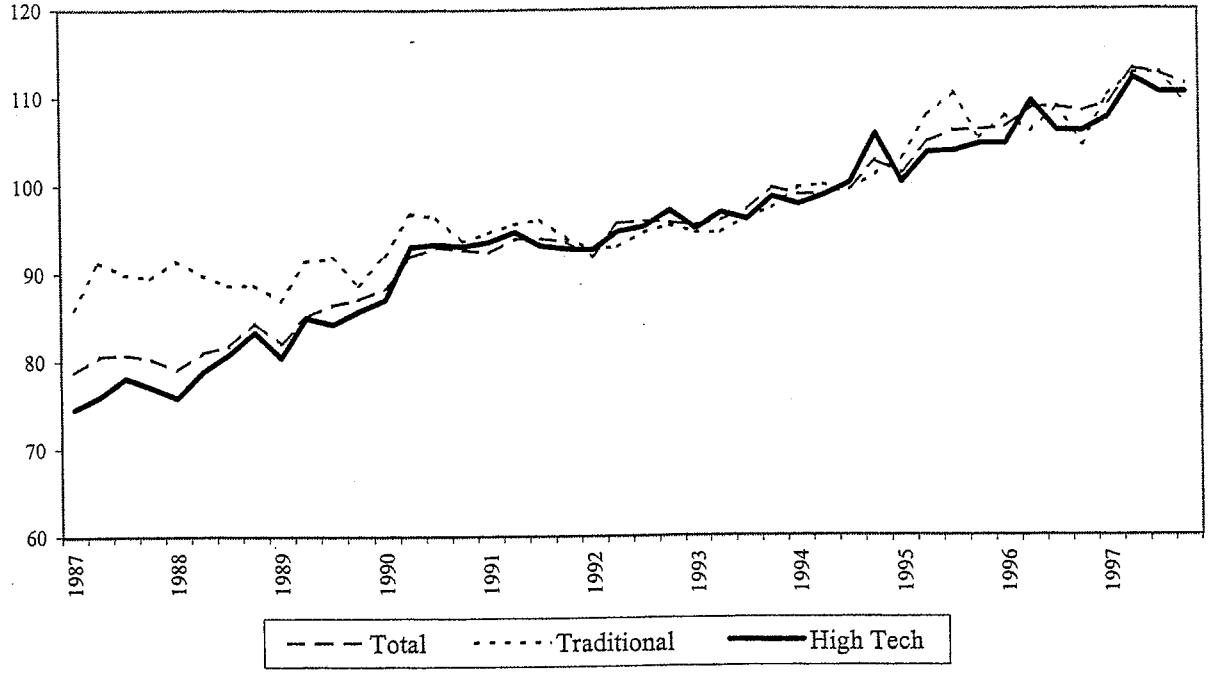


Figure 8. Unit Labor Costs
(1994=100)

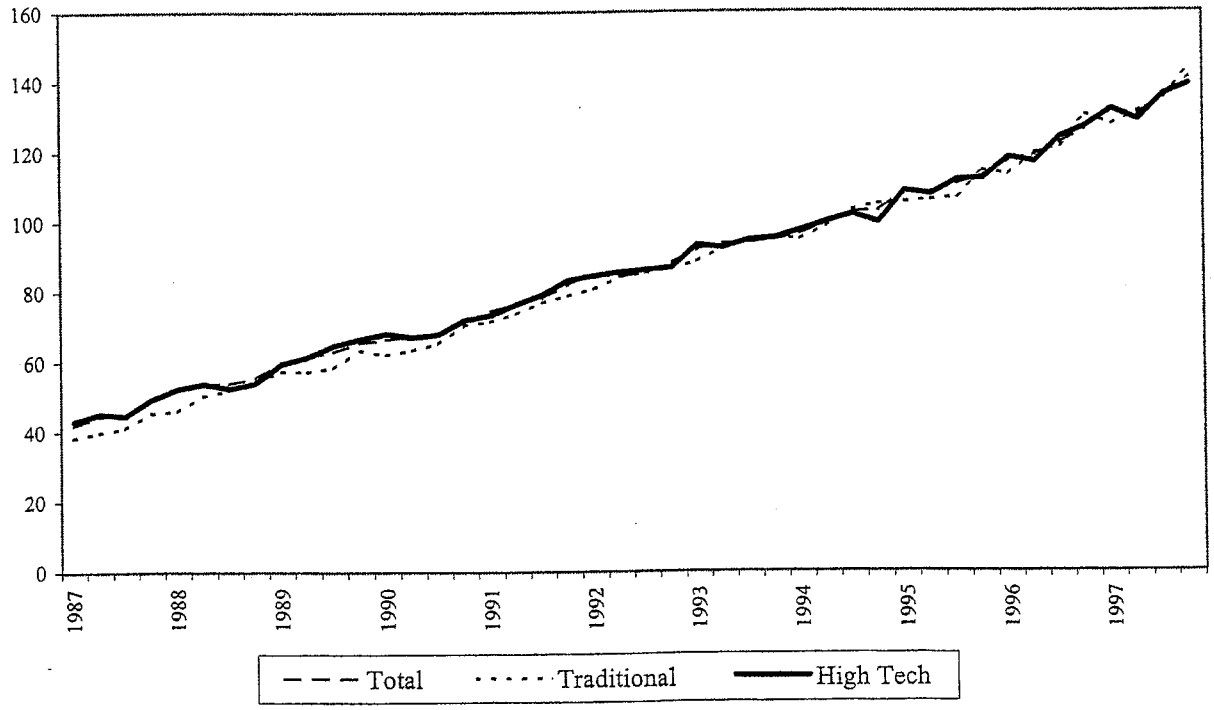


Figure 9. Export Prices in U.S. dollars
(1994=100)

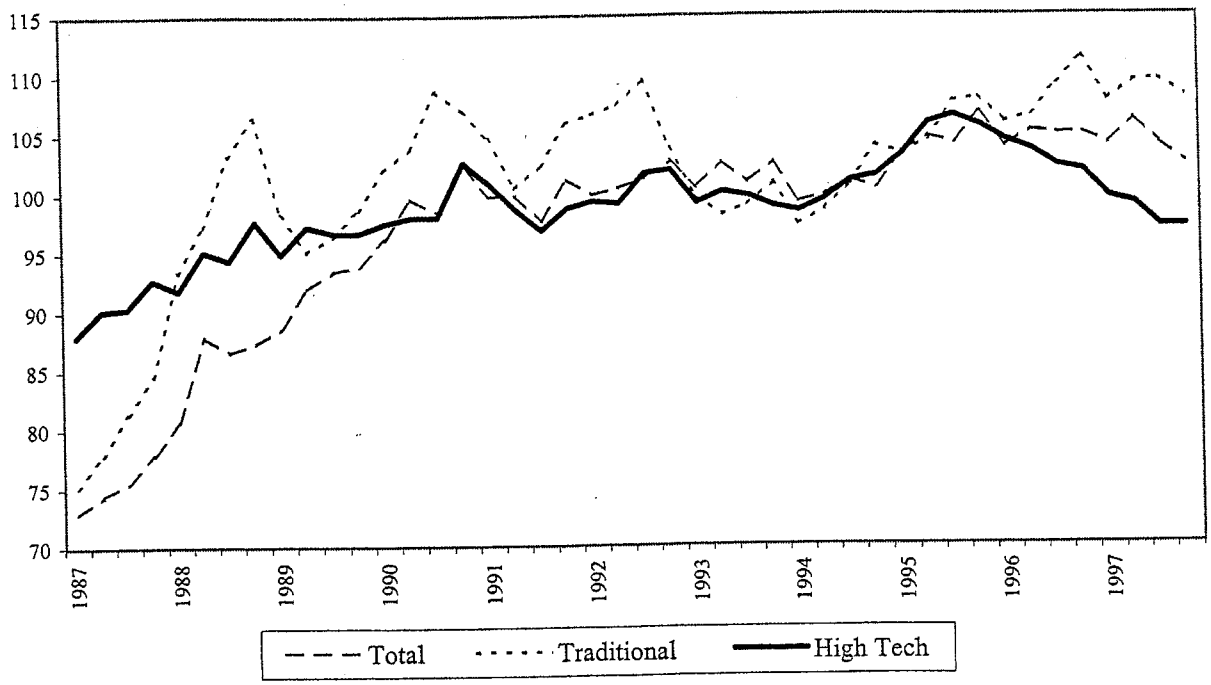
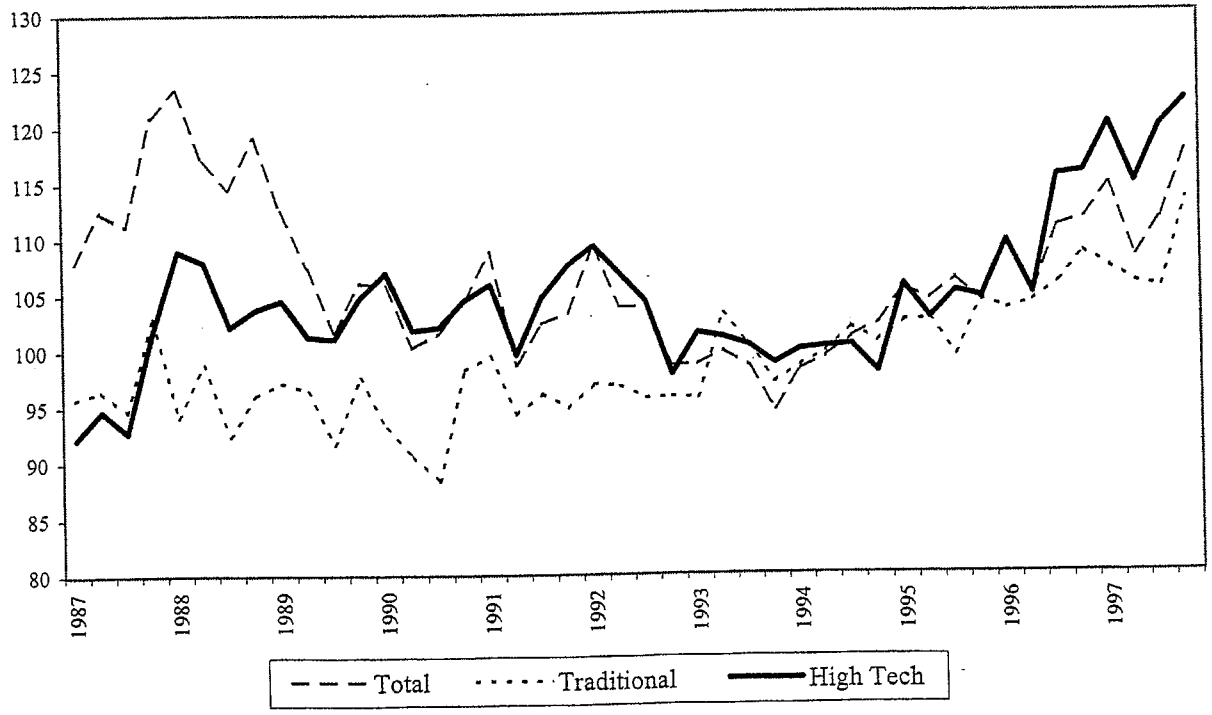


Figure 10. Real Exchange Rates
(ULC based; 1994=100)



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