Appendix: Hypotheses about Macro-economic and Individual Variables and Probit Results

Time-specific macroeconomic conditions (E_t):

Changes in macro-economic conditions in Chile, which were large during 1960-2002, constitute a leading potential counter-explanation for rising labor force participation rates. The country went through a period of economic chaos and hyper-inflation during the early 1970's, high unemployment during the late 1970's and prolonged growth punctuated by cycles from the mid-80's through 2004. We control for these macro-economic changes using 2 variables—*deviations from H-P trend*, which measures cyclical deviations from the long-term growth trend and *unemployment rate*.

Deviations from H-P trend = real lnGDP growth minus the Hodrick-Prescott filter (a smoothed non-linear representation of long term GDP growth). It is a measure of short-term business cycles and shows severe downturns during the 1970's as well as in the 1990's. The existence of a complete business cycle from the mid-1980's through 2004 is important as it reduces the correlation between the phase-in of the reform and economic growth, and allows us to separate out these effects.

The *unemployment rate* in Chile was 8% in 1960, fell to 3% by 1973 and then rose to 23% by 1982. During the post-reform period, unemployment went through an entire cycle, falling to 6% by 1995 and then rising to 14% by 2002. The *unemployment rate* should behave much like *deviations from H-P trend*, but with the opposite sign. We expect pension probabilities to rise and LFP to fall during cyclical downturns in the economy, due to the discouraged worker effect, the difficulty older workers may experience in obtaining new jobs when laid off from their existing jobs, and the greater ease of meeting early retirement pre-conditions.

Individual characteristics (Xi)

A set of individual characteristics (*education, real per capita household income minus own wage and pension, marital status, number children, age difference of spouse, having a working spouse*) are included in all regressions. These determine the person's potential wage and willingness to trade off wages for leisure. Because the distribution of these demographic characteristics varies strongly over time, they also constitute a possible explanation for the observed trends in aggregate participation rates. This holds most particularly for education, real per capita household income and female labor force participation rate.

Education is represented by two variables: *6 years or less of schooling* = dummy for persons who did not go beyond primary education and *12 years or more years of schooling* = dummy for persons with post-secondary education. Major educational gains took place in Chile between Coh_0 and Coh_6. The proportion of individuals with only primary education was cut by more than half—from 51% for COH_0 to 23% for COH_6--while the proportion of individuals with post-secondary education doubled—from 26% for COH_0 to 50% for COH_6. On the one hand, higher education exerts a lifetime income or wealth effect that might lead to earlier withdrawal from the labor force; but on the other hand it also has a positive substitution effect on work propensities, by raising the pecuniary reward for work and experience and access to more interesting jobs. Workers with only primary education may work longer in order to meet the 20-year eligibility criterion for the minimum pension guarantee. Adding to these pushes and pulls, more educated individuals are more likely to satisfy the early pension eligibility constraints and therefore to stop work sooner with a pension. The net impact of education on participation rates is therefore uncertain a priori.

Similarly, we control for *real per capita household income* minus the person's own wage and pension. *Real per capita household income* rose substantially—trebling, on average, from

COH_0 to COH_6. It has been argued in the U.S. literature that long-term income growth is a major reason behind the decline in pension age and labor supply and the increase in retirement leisure of older male workers. This may apply to the individual's non-wage income, included in *household income*. However, wage income from other household members may be correlated with the individual's potential wage, which may generate a substitution effect toward work. The sign on *real per capita household income* informs us of whether the income or substitution effect dominates in Chile, cross-sectionally and over time.

Marital status and children. Decisions about work and retirement may be strongly influenced by whether the individual is married, has a working wife and has dependent children to support. The presence of a spouse and children may lead him to postpone pensioning and work longer to support them. This is especially the case if the wife is much younger than the husband. If the wife works, the couple may wish to coordinate their retirement decisions, which may again lead the husband to postpone pensioning and work longer. This effect is accentuated if the husband wishes to avoid the housework he might otherwise be expected to do. But the incentive to work more is mitigated for non-pensioners, who now face a weaker liquidity constraint. Female labor force participation increased even more sharply than that of men during the post-reform period, in part due to the increased educational levels of women.

We control for all these variables to throw light on the male retirement decision and to make sure we are not confusing the reform effect with effects stemming from income, education and female labor force participation that were changing at the same time.

TABLE A1: NUMBER OF OBSERVATIONS BY COHORT AND AGE

		Number observations, by age range			
Cohort	**Year of birth**	**50 to 54**	**55 to 59**	**60 to 64**	**65 to 70**
COH_0	1900-1915	1,450	2,052	2,371	2,485
COH_1	1916-1925	2,660	1,859	1,596	1,642
COH_2	1926-1930	1,342	938	874	802
COH_3	1931-1935	1,260	915	836	805
COH_4	1936-1940	1,236	880	748	322
COH_5	1941-1945	1,270	939	366	
COH_6	1946-1950	1,410	490		

TABLE A2: NUMBER AND % OF PENSIONERS IN SAMPLE, BY COHORT AND AGE

	Number pensioners, by age range					Pensioners as % of total obs		
Cohort	**Year of birth**	**50 to 54**	**55 to 59**	**60 to 64**	**65 to 70**	**50-59**	**60-64**	**65-70**
COH_0	1900-1915	221	449	771	1,345	19	33	54
COH_1	1916-1925	348	499	613	1,059	19	38	64
COH_2	1926-1930	204	229	330	486	19	38	61
COH_3	1931-1935	193	165	275	500	16	33	62
COH_4	1936-1940	105	149	212	183	12	28	57
COH_5	1941-1945	101	149	100		11	27	
COH_6	1946-1950	98	72			9		

TABLE A3: PROBIT MODEL FOR PROBABILITY OF PENSION and LABOR FORCE PARTICIPATION (LFP)--full sample, no pension controls

	Pension probability		**LFP rate, no pension controls**	
	Coefficient	P value	Coefficient	P value
Age Group 50-59				
COH_0	-1.205	0	0.958	0
COH_1	0.005	0.884	-0.051	0.145
COH_2	-0.043	0.334	-0.023	0.604
COH_3	-0.143	0.001	0.066	0.135
COH_4	-0.307	0	0.252	0
COH_5	-0.351	0	0.366	0
COH_6	-0.424	0	0.467	0
Age Group 60-64				
COH_0	-0.006	0.907	-0.113	0.021
COH_1	0.053	0.329	-0.214	0
COH_2	0.068	0.253	-0.173	0.004
COH_3	-0.039	0.516	0.029	0.63
COH_4	-0.230	0	0.249	0
COH_5	-0.179	0.024	0.321	0
Age Group 65-70				
COH_0	0.030	0.674	-0.206	0.004
COH_1	0.232	0.002	-0.352	0
COH_2	0.218	0.007	-0.198	0.014
COH_3	0.182	0.026	-0.074	0.366
COH_4	0.193	0.043	-0.020	0.834
Other Covariates				
Age - 50	0.065	0	-0.062	0
Age - 60 if age>60	-0.007	0.528	0.008	0.457
Age - 64 if age>64	0.049	0	-0.053	0
6 or less years of schooling	-0.203	0	0.099	0
12 or more years of schooling	0.008	0.701	0.101	0
Real household income/capita	0.000	0.011	-0.0002	0
Number of children younger than 18	-0.050	0	0.059	0
Spouse present	0.223	0	0.122	0
Spouse in the labor force	-0.340	0	0.275	0
Spouse age differential (Husband-Wife)	-0.010	0	0.013	0
Unemployment Rate	0.946	0	-0.826	0
Log likelihood		-15984		-15902
# of observations		31,579		31579
Pseudo R2		0.1475		0.1573

TABLE A4: PROBIT MODEL FOR PROBABILITY OF LABOR FORCE PARTICIPATION--full sample, controlling for pension effects

	COH effects		COH*Pensioner interactions	
Age Group 50-59	Coeff.	pvalue	Coeff.	pvalue
COH_0	1.461	0	-2.371	0
COH_1	0.027	0.626	-2.669	0
COH_2	-0.013	0.851	-2.585	0
COH_3	0.054	0.43	-2.669	0
COH_4	0.142	0.04	-2.531	0
COH_5	0.160	0.019	-2.098	0
COH_6	0.132	0.075	-1.837	0
Age Group 60-64				
COH_0	-0.105	0.17	-2.568	0
COH_1	-0.102	0.225	-2.856	0
COH_2	0.034	0.731	-2.903	0
COH_3	0.139	0.161	-2.613	0
COH_4	0.136	0.188	-2.284	0
COH_5	0.201	0.117	-2.122	0
Age Group 65-70				
COH_0	-0.072	0.527	-2.855	0
COH_1	-0.142	0.246	-2.775	0
COH_2	0.138	0.304	-2.846	0
COH_3	0.062	0.649	-2.419	0
COH_4	0.214	0.195	-2.535	0

Other Covariates	Coef.	Pvalue
Age - 50	-0.049	0
Age - 60 if age>60	-0.010	0.567
Age - 64 if age>64	-0.043	0.058
pensioner*(Age - 50)	0.039	0
pensioner*(Age - 60 if age>60)	0.046	0.112
pensioner*(Age - 64 if age>64)	0.000	0.993
6 or less years of schooling	-0.068	0.008
12 or more years of schooling	0.197	0
Pseudo replacement rate	-0.092	0
Real household income/capita	0.000	0
Number of children younger than 18	0.046	0
Spouse present	0.436	0
Spouse in the labor force	0.035	0.236
Spouse age differential (Husband-Wife)	0.011	0
Unemployment Rate	-0.335	0.179
Log likelihood		-9715
# observations		31,376
Pseudo R^2		0.4783

TABLE A5: PROBIT MODEL FOR PROBABILITY OF LABOR FORCE PARTICIPATION—separate samples for pensioners and non-pensioners

	Non-pensioners		Pensioners	
	Coef.	Pvalue	Coef.	Pvalue
Age Group 50-59				
COH_0	1.399	0.000	-0.699	0
COH_1	0.038	0.502	-0.278	0
COH_2	-0.024	0.707	0.029	0.745
COH_3	0.059	0.422	-0.014	0.895
COH_4	0.085	0.277	0.208	0.078
COH_5	0.044	0.572	0.404	0.001
COH_6	-0.024	0.762	0.190	0.142
Age Group 60-64				
COH_0	-0.100	0.197	-0.285	0.004
COH_1	0.017	0.804	-0.320	0
COH_2	0.130	0.160	0.098	0.386
COH_3	0.112	0.298	0.392	0.002
COH_4	0.010	0.928	0.282	0.027
COH_5	0.079	0.573	0.179	0.256
Age Group 65-70				
COH_0	-0.071	0.538	-0.534	0
COH_1	-0.069	0.339	-0.011	0.875
COH_2	0.289	0.006	0.215	0.015
COH_3	-0.058	0.631	0.307	0.002
COH_4	0.184	0.245	0.036	0.769
Other Covariates				
Age - 50	-0.050	0.000	-0.010	0.277
Age - 60 if age>60	-0.009	0.621	0.029	0.196
Age - 64 if age>64	-0.044	0.055	-0.039	0.123
6 or less years of schooling	-0.068	0.039	-0.044	0.285
12 or more years of schooling	0.322	0.000	0.063	0.126
Pseudo replacement rate			-0.106	0
Real household income/capita	-0.001	0.000	0.00005	0.648
Number of children younger than 18	0.044	0.004	0.042	0.028
Spouse present	0.559	0.000	0.180	0
Spouse in the labor force	-0.117	0.001	0.259	0
Spouse age differential	0.013	0.000	0.009	0.002
Unemployment Rate	-0.565	0.085	-0.004	0.991
Log likelihood		-5521	-4115	
# of observations		22711	8665	
Pseudo R2		0.1529	0.0576	